Corps of Engineers Northwestern Division
North Pacific Region
Portland, Oregon

2003

Water Quality Annual Report

Prepared with input from:
Portland District
Seattle District
Walla Walla District
North Pacific Region

Table of Contents

1. Summary

This report on the 2003 Water Quality Program was prepared in conformance with ER 1110-2-8154 and NPDR 1110-2-101. Dredging was also included for reference purposes. The report only covers programs and activities within the North Pacific Region of the Northwestern Division (Portland, Seattle and Walla Walla Districts).

NWD-NP division-wide 2003 Water Quality Management Program Contracts is estimating a total of $2 million. (See Table 1).

The water quality and water quality-related highlights of the year included the following events/activities:

- ✓ Flow augmentation and spill-for-fish-passage measures needed to improve fish survival in the Columbia/Snake waterway continued to affect water quantity and quality.

- ✓ The Corps took appropriate actions for attaining a water quality variance from the State of Oregon for the 2003 spill season. On December 23, 2002, the Corps submitted a letter to the Oregon Department of Environmental Quality (ODEQ) requesting a multi-year waiver of the Total Dissolved Gas (TDG) standard for the purpose of assisting out-migrating threatened and endangered salmon smolts during the spill seasons of each year (April 1 through August 31). The Oregon Environmental Quality Commission met on March 11, 2003 and approved a multi-year variance for the 2003 through 2007 spill seasons, subject to specific conditions. The waivers temporarily raised the TDG standards from 110 percent to 120 percent in the tailwater of the spilling dam, and from 110 percent to 115 percent in the forebay of the next downstream dam (and at the Camas/Washougal monitoring station).

- ✓ The State of Idaho was approached in 2001 concerning a variance to water quality standards. The State, in conjunction with the tribes, provided a set of conditions that must be met as part of the variance process. Due to the conditions provided by the State and tribes, the forecasted runoff conditions and the foreseen use of Dworshak water releases. The Corps has not continued to pursue water quality standard variances from the State of Idaho since that time.

- ✓ The Corps took appropriate action for attaining a water quality exemption from the State of Washington for the 2003 spill season as per WAC 173-201A-200(1)(f)(ii). On December 23, 2002, the Corps submitted a letter along with the appropriate supplementary materials to the Washington Department of Ecology (WDOE) requesting a multi-year waiver of the Total Dissolved Gas (TDG) standard for the purpose of assisting out-migrating threatened and endangered salmon smolts during the spill season. The WDOE responded in a letter dated 18 March 2003 granting only a single year waiver, subject to specific conditions. Like the Oregon waiver, the exemption allows TDG levels up to 120 percent in the tailwater of the spilling

dam and 115 percent in the forebay of the next downstream dam. The Corps is continuing informal discussions with the State of Washington to replace year-to-year variances with long-term variances.

- ✓ As part of the National Marine Fisheries Service's (NMFS) 2000 BiOp, a jeopardy analysis framework was developed. As a result of this framework, 14 Reasonable and Prudent Alternatives (RPAs), RPAs 130 to 143, were identified as part of an overall water quality strategy. Specifically, RPA's 131 and 132 deal with water quality monitoring. RPA 131 indicates that the physical and biological monitoring programs are to be developed in consultation with Regional Forum Water Quality Team and the Mid-Columbia Public Utility Districts (PUDs). Efforts moved forward in 2003. RPA 132 specifies that a plan must be developed to perform a systematic review and evaluation of the TDG fixed monitoring stations (FMSs) in the forebays of all the mainstem Columbia and Snake River dams. Two studies were conducted addressing measures from Federal Biological Opinions (BiOp's). Temperature loggers were used for thermal sampling to support initial modeling studies. Total Dissolved Gas (TDG) fixed monitoring station forebay sites were evaluated for representativeness of TDG and temperature. Automated water quality multi- probe loggers were used during the 2003 fish spill season.

- ✓ The Districts continued to be responsible for all TDG field monitoring functions. Portland, Seattle, Walla Walla Districts. The current TDG network included 27 Corps fully automated data collection and transmission facilities installed in forebays and tailwater areas of all Columbia and Snake River mainstem dams and some riverine sites.

- ✓ The US-Canada Transboundary Gas Group (TGG) continued to meet twice a year. This international technical group is designed to cooperatively undertake TDG abatement studies on a systemwide basis. Representatives of NOAA Fisheries, EPA and the Northwest Power Planning Council are currently the U.S. leads on this effort. The TGG has developed a "Framework Plan for Coordinating Activities of the Columbia River Transboundary Gas Group".

- ✓ The NMFS 2000 BiOp identified metrics that are indicative of juvenile fish survival to meet system-wide performance objectives consistent with actions likely to avoid jeopardizing the continued existence of 12 listed fish species in the Columbia River Basin. To achieve the objectives of the BiOp, NOAA Fisheries, developed the jeopardy analysis framework. It was recognized that, in many instances, actions taken for the conservation of ESA-listed species also move toward attainment of State TDG and water temperature standards.

- ✓ Water quality conditions at most reservoirs and lakes in the Northwestern Division, North Pacific Region remained practically unchanged from the previous years (see Table 4).

- ✓ The Portland District cooperated with resource agencies by monitoring water quality during construction activities at Cougar. Ongoing monitoring involved measuring temperature and turbidity upstream of the project and temperature, turbidity, and DO downstream of the project as well as Hydrolab profiles of the lake at three stations.

- ✓ The Seattle District continued to pursue a dissolved gas abatement study at Chief Joseph Dam in consultation with Washington State and the NOAA Fisheries regional forum. As called for in the 2000 NMFS Biological Opinion for salmon, the merits of operating Chief Joseph and Grand Coulee Dams jointly for dissolved gas abatement were examined in a system wide study.

- ✓ Improvements in water and wastewater sampling and systems operation were attained at Little Goose and Lower Granite Dams. Wastewater sludge hauling was utilized to improve effluent quality at Little Goose Dam. Operational tests were performed and new sampling equipment was procured. Sampling and testing were performed according to state and federal guidelines.

- ✓ At Ice Harbor Dam cooling and potable water intakes were separated to accommodate plans for improved water treatment. Nine District swim beaches were monitored for fecal coliform bacteria.

Listed below for the Division and the three Districts are more specific water quality highlights for 2003.

1.1. Northwestern Division Highlights

- ✓ Day-to-day coordination of the basin wide TDG monitoring program in the Columbia River Basin.

- ✓ Pursued actions needed from the States of Oregon and Washington to obtain TDG variances. Continued attempts to obtain a long-term variance from the State of Washington.

- ✓ Implemented relevant sections of the 2000 BiOp regarding operations that impact Water Quality and Environmental issues.

- ✓ Provided river operation and fisheries managers with synthesized and relevant information needed to control dissolved gas supersaturation in the river system on a real time basis.

- ✓ Participated in the activities of the Technical Management Team (TMT), a regional inter-agency group to advise on the weekly or biweekly reservoir operation for the salmon recovery in the Columbia River Basin.

- ✓ Evaluated how project releases affect downstream water quality and aquatic habitat relative to ESA Biological Opinion measures and CWA related state and tribal dissolved gas standards.

- ✓ Actively contributed to the preparation of the following annual planning documents: (1) 2003 Water Management Plan for the Columbia and Snake River system, for use by the TMT, (2) 2003 TDG Management Plan (for attachment to the TMT's Water Management Plan), (3) Plan of Action for the 2003 TDG monitoring, and (4) update of the Water Quality Plan for Total Dissolved Gas and Water Temperature in the Mainstem Columbia and Snake Rivers.

- ✓ Identified long-term changes in basin wide dissolved gas saturation levels resulting from water management decisions (structural and operational) and/or natural processed, i.e., trend monitoring.

- ✓ Continued active participation in other regional forums dealing with water quality, including coordination of TDG-related regional research plan as part of the NOAA Fisheries Water Quality Team, the regional Water Quality Plan group, and coordination with EPA, the states and tribes in the development of mainstem Columbia River TMDLs.

1.2. Portland District Highlights

- ✓ Completion of the eighth year of successful assumption of direct responsibility for dissolved gas monitoring at 8 stations on the lower Columbia River starting from John Day forebay, using the services of the USGS. Data loss for WY 2003 was less than 1 percent. Studies of representativeness of gas monitoring stations lead to recommending new sites at John Day and Bonneville.

- ✓ Participation in a cooperative effort with the U. S. Forest Service/ City of Salem concerning turbidity studies in the upper Santiam River watershed.

- ✓ Water continued to be released from Lost Creek and Applegate to improve Spring Chinook and Fall Chinook salmon spawning conditions. Flow and water temperature targets were again met. Routine water quality monitoring for nutrients and limnological parameters continued at both projects.

- ✓ As part of the PAS program (Planning Assistance to the States) water temperatures were monitored at 10 locations – 3 above Green Peter, one below Hills Creek, one each above Lookout Point, Dorena and Cottage Grove, and three in the McKenzie River – all to assist the state in its modeling effort regarding a temperature TMDL.

- ✓ The selective withdrawal structure, designed to aid locals in improving downstream water temperatures, was used on a more limited basis than previous

years. This was due to dry conditions in 2003 that resulting in the sale of reservoir water at Willow Creek Lake for irrigation.

- ✓ Aeration equipment was purchased for installation at Willow Creek to improve water quality by decreasing the H_2S and methane concentrations.

- ✓ Continuous findings of no contamination in dredged material samples collected from selected NWP's project sites.

1.3. Seattle District Highlights

- ✓ The District continued to be an active participant in the Instream Flow Commission, a multi-agency commission to establish flows for the Cedar River, a tributary to Lake Washington.

- ✓ The District continued to monitor water temperature at Wynoochee Dam, owned by the City of Aberdeen and operated by Tacoma Public Works Department.

- ✓ The District continued to study the water quality effects of increased conservation storage at Howard A. Hanson Dam. Routine water quality monitoring for conventional, nutrients, and phytoplankton was conducted from April through October.

- ✓ Temperature strings were installed at Chief Joseph Dam in Lake Rufus Woods at three locations. These strings measured temperature at various water column depths from June through October.

- ✓ A temperature string was installed at Libby Dam in Lake Koocanusa at the forebay. This string measured temperature at various water column depths from April through November.

- ✓ The District completed a study monitoring ground water quality in the Kootenai River valley near Libby Dam before, during, and after the spill test to better quantify how river flows affect the ground water system.

- ✓ The District, along with the USGS, continued to monitor surface and ground water on the North Satus Creek Drain in the Yakima River Basin. The purpose of the study is to determine if the water quality of agricultural return flows water in the North Satus Creek Drain is acceptable for use in a wetland mitigation project.

- ✓ The District continued to monitor total dissolved gas at two permanent water quality sites (forebay and tailwater) at Chief Joseph Dam.

- ✓ The District continued to monitor water quality throughout the Lake Washington Ship Canal (5 permanent water quality stations collecting salinity and

temperature data), and in Lake Koocanusa and the Kootenai River (4 permanent water quality stations collecting conventional, nutrients, metals, and phytoplankton data).

- ✓ The District continued to monitor temperature and discharge in rivers and streams throughout Washington, Northern Idaho, and Western Montana.

- ✓ The District continued to participate in numerous fish studies throughout the Green and Cedar River basins to improve the water quality and habitat of salmonids.

- ✓ The District conducted a total dissolved gas (TDG) exchange study at Albeni Falls Dam from May through August 2003. The purpose of the study was to define and quantify processes that contribute to dissolved gas transfer during spill releases at Albeni Falls Dam.

- ✓ One permanent TDG monitoring station was installed at the tailwater of Libby Dam to monitor the impact of dam operations on the Kootenai River.

- ✓ The District implemented a study at Chief Joseph Dam to characterize the quality of relief tunnel and forebay waters throughout the water year to determine if the water is of sufficient quality for use at a proposed Colville Tribe fish hatchery.

- ✓ The District conducted a study of Chief Joseph Dam and Grand Coulee Dam joint operations to minimize TDG concentrations in the Columbia River downstream of Grand Coulee Dam.

- ✓ The District conducted a total dissolved gas management study at Libby Dam to provide a feasibility assessment of various structural and operational alternatives that could reduce TDG in the Kootenai River below the dam.

1.4. Walla Walla District Highlights

- ✓ The 2003 water year was somewhat below average. The average inflow at Lower Granite Dam was approximately 20,397 KAF compared to the long-term mean of 24,510 KAF.

- ✓ Temperature measurements were made in Dworshak Reservoir using Onset Optic Stowaway®, Tidbit® and Hobo Pro® sensor temperature loggers. Temperature was programmed for hourly recordings throughout the year at six reservoir and eight tributary inlet sites. Data was downloaded and new loggers were installed at the stations.

- ✓ A variety of water quality and limnological samples were collected at sites in McNary Reservoir, the Lower Snake and Clearwater Rivers. Parameters tested

included temperature, oxygen, pH, conductivity, alkalinity, ammonia, nitrate, phosphorous and chlorophyll. The objectives of the study were to gather information that could be used by the water quality staff to: (a) advise operations regarding water releases intended for downstream cooling, (b) select additional locations for temperature monitoring as needed, and (c) evaluate long term trends.

- ✓ Two studies were conducted addressing measures from Federal Biological Opinions (BiOp's). Temperature loggers were used for thermal sampling to support initial modeling studies. Total Dissolved Gas (TDG) fixed monitoring station forebay sites were evaluated for representativeness of TDG and temperature. Automated water quality multi- probe loggers were used during the 2003 fish spill season.

- ✓ High-density polyethylene submerged pipe systems were installed for (TDG) sonde deployment in tailwater stations at Pasco, Lower Monumental, Little Goose, and Lower Granite. Repairs and improvements were also made at the Lewiston and Dworshak stations. The new designs incorporated heavy-duty chain around the pipes, larger diameter cabling and additional anchoring.

- ✓ Sediment sampling was conducted for the proposed 2003/2004 Lower Snake River dredging. Sediments from ten dredge template sites were analyzed for chemical and physical parameters. Approximately 200 organic herbicides, pesticides and industrial compounds were considered.

- ✓ Reservoir sediment sampling was conducted at six additional sites for Woody Riparian Habitat mitigation under the Corps of Engineer's Lower Snake River Fish and Wildlife Compensation Plan. Temperature, velocity and bathymetry recordings were also made.

- ✓ Improvements in water and wastewater sampling and systems operation were attained at Little Goose and Lower Granite Dams. Wastewater sludge hauling was utilized to improve effluent quality at Little Goose Dam. Operational tests were performed and new sampling equipment was procured. Sampling and testing were performed according to state and federal guidelines.

- ✓ A new water treatment system was installed at Dworshak Dam for potable water. A SCADA (supervisory control and data acquisition) system automatically monitors various water quality parameters.

- ✓ At Ice Harbor Dam cooling and potable water intakes were separated to accommodate plans for improved water treatment. Nine District swim beaches were monitored for fecal coliform bacteria.

1.5. Contracts

District water quality contracts are summarized in Table 1.

Table 1. 2003 Water Quality Contracts (in $1,000s)

Offices	Universities and AE's	Other Corps	Other Federal	Water Quality	Sediment Quality	Total WQ+SQ
NWD-NP						
NWP	845.7	7.0	455.9	738.3	337.7	1308.2
NWS	34.5	50.0	72.0	156.5	94.0	250.5
NWW	658.0		44			
TOTAL	1579.7	193.0	538.9	1158.3	733.3	1891.6

1.6. Summary of Water Quality Conditions

Most important issues & accomplishments are shown in Table 2.

Table 2. Issues/Concerns & Accomplishments

Most Important Issues/Concerns	Most Important Accomplishments
NWD-NP 1. Dissolved gas supersaturation. 2. Water Temperature. 3. Regional coordination with the Regional Forum Water Quality Team. 4. Regional coordination for development of TMDL's.	NWD-NP. 1. TDG: Coordination & Applications. 2. Activities within TMT and DGT Teams. 3. Coordination of NWD-NP-WQ programs.
NWP 1. TDG in Lower Columbia River Projects. 2. TDG and Temp. TMDLs in Willamette & L. Columbia River. 3. Columbia and Willamette River BiOPs – RPAs.	NWP 1. Successful TDG fixed monitoring program. 2. PAS support to Oregon for TMDL development.
NWS 1. Disposal of dredged material. 2. Saltwater intrusion in Lake Union. 3. Water Temperature at Libby Dam and Chief Joseph Dam.	NWS 1. Albeni Falls Dam TDG study. 2. Chief Joseph and Libby temperature study. 3. Howard Hanson Reservoir limnological study.

Most Important Issues/Concerns	Most Important Accomplishments
NWW 1. Public health. 2. Impacts of proposed dam breaching and dredging. 3. High temperatures in Lower Snake and McNary Reservoirs. 4. High temperatures in the Lower Snake River and McNary reservoir. 5. Total Dissolved Gas Monitoring.	NWW 1. Project water and wastewater management and water quality testing. 2. Physical and chemical characteristics of sediments in the Lower Snake River, Study and Report 2003/2004 proposed dredging. 3. Sediment and lake physical regime sampling Woody Riparian Study Lower Snake River Basin. 4. TDG fixed Monitoring Station Renovation. 5. TDG forebay fixed monitoring station review and evaluation Lower Snake River and McNary dam.

A summary of Northwestern Division water quality conditions is shown in Table 3.

Table 3. Summary of 2003 Water Quality Conditions

Districts/ Projects	Ratings	Historical Problems	2003 Problems	Future Problems
Portland				
1. Lost Creek	Good	Outflow temperature	Outflow temperature, algae bloom	Outflow temperature, algae blooms
2. Applegate	Good	Outflow temperature, mercury	Outflow temperature, algae bloom	Outflow temperature, mercury, anoxia
3. Fall Creek	Good	H_2S, algae, anoxia	Outflow temperature	Algae, temp.
4. Hills Creek	Fair	Turbidity, algae, outflow temperature	Outflow temperature, major anabaena bloom	Turbidity, algae blooms
5. Lookout Pt.	Good	None	TDG, Outflow temperature	TDG, temp
6. Dexter	Fair	Algae, macrophytes	TDG, Outflow temperature, anabaena bloom	TDG, temperature, algae blooms
7. Dorena	Fair	Mercury	Mercury, anoxia	Mercury, anoxia
8. Cottage Gr.	Fair	Mercury	Mercury, anoxia, temp	Mercury, anoxia, temp
9. Fern Ridge	Poor	Eutrophication, nuisance aquatic plants	Nutrients, nuisance aquatic plants	Eutrophication, aquatic plants

Districts/ Projects	Ratings	Historical Problems	2003 Problems	Future Problems
10. Willow Cr.	Poor	Enrichment	Anoxia, H_2S, nutrients, methane, algae blooms, fecals	Anoxia, H_2S, nutrients, methane, algae blooms, fecals
11. Cougar	Poor	Outflow Temperatures	Outflow temperature, anabaena bloom	Temperature, algae blooms
12. Blue River	Good	Outflow temperatures	Outflow temperature	Temperature, algae blooms
13. Detroit	Good	Outflow temperatures, turbidity	Turbidity, outflow temperature	Turbidity, outflow temperature, algae blooms
14. Big Cliff	Good	Temperature, turbidity	Turbidity, outflow temperature	Turbidity, outflow temperature
15. Green Peter	Good	Turbidity, Outflow temperatures	Outflow temperature	Turbidity, outflow temperature, algae blooms
16. Foster	Good	Turbidity, temperature	Outflow temperature	Turbidity, outflow temperature
17. Bonneville	Good	Dissolved gas, temperature	TDG>110%	TDG, temperature, nutrients, toxics
18. The Dalles	Good	Dissolved gas, temperature	TDG>110%	TDG, temperature, nutrients, toxics
19. John Day	Good	Dissolved gas, temperature	TDG>110%	TDG, temperature, nutrients, toxics
Seattle				
1. Libby Dam	Good	Nutrients, metals, temperature	None	Temperature, TDG
2. Albeni Falls	Good	Temperature, metals	Temperature	Temperature, TDG, nutrients, macrophytes
3. Chief Joseph	Good	Dissolved gas, temperature	Temperature	Temperature, TDG, nutrients, algae, macrophytes
4. Mud Mountain	Good	Turbidity, sediments	None	Turbidity, sediments
5. Howard Hanson	Good	Temperature, turbidity	None	Turbidity, temperature, nutrients, algae
6. Lake Washington Ship Canal	Fair	Saltwater intrusion, contaminated sediments	Saltwater intrusion	Benthic O_2 Demand

Districts/ Projects	Ratings	Historical Problems	2003 Problems	Future Problems
7. Lake Union	Fair	Contaminated sediments, sediment oxygen demand, saltwater intrusion	Contaminated sediments, sediment oxygen demand	Contaminated sediments
8. Wynoochee	Good	Temperature	Temperature	Temperature
Walla Walla				
1. Dworshak	Good	Trash/Debris, TDG, Turbidity, potable water	Algae and Turbidity Temporary potable water permit/new system evaluation	Increase withdraw and drawdown, Decreased fish productivity
2. Lower Granite	Fair	High TDG at peak flows. High summer water temperatures. Increased nutrient loading. Reduced water velocities due to blue green algae blooms.	No NPDES permits for fish facility outflows. Still operating on temporary wastewater NPDES permits. System needs to be operated and maintained on a daily basis.	Sediments impacting dredging operations and contributing to eutrophic conditions at low flows. Increased pesticide and herbicides in runoff.
3. Little Goose	Fair	Elevated TDG during high flows	No NPDES permit for fish facility outflows. Still operating on temporary wastewater NPDES permit. Hydraulic loading occasionally over capacity for wastewater. System needs composite sampler and load splitter.	Sediments impacting dredging operations and contributing to eutrophic conditions at low flows. Increased pesticide and herbicides in runoff.
4. Lower Monumental	Fair	Elevated TDG at high flows		Same as future problems at Little Goose and Lower Granite

Districts/ Projects	Ratings	Historical Problems	2003 Problems	Future Problems
5. Ice Harbor	Fair	Water needing treatment for nitrates	Charbonneau Park well water high nitrate.	High water temperatures. Non-point source nutrient loading. Pesticide and herbicide runoff.
6. McNary	Fair	Elevated TDG, High water temperatures		Temperature. Non-point source nutrient loading.
7. Lucky Peak	Good	None	Swimmer's itch	Increase demand, non-point source nutrient loading
8. Mill Creek	Fair	Turbidity, thermal stratification, anoxia, seepage.	Sedimentation	High Turbidity, caused by reservoir refill

2. Water Quality Management Program

2.1. Introduction

This portion of the report summarizes the Northwestern Division (North Pacific Region) Water Quality Management Program for program objectives, major activities, accomplishments in 2003, and proposed objectives for 2003. The report conforms to ER 1110-2-8154, Water Quality and Environmental Management for Corps Civil Works Projects dated 31 January 1995, and with NPDR 1110-2-101, Water Control Management - Quality, dated 19 December 1986.

2.2. Organization And Coordination

Most NWD-NP Reservoir Control Center water quality programs are surveillance and monitoring in nature. These programs are to ensure that Corps activities meet all applicable federal, state and local standards to the full extent possible. In some cases, water quality programs can be project-specific and lead to changes in project operations and/or design features. An example is dissolved gas monitoring and its use in adjusting real-time spill on the mainstem Columbia and Snake Rivers or longer term efforts of changing spill patterns and modifying spillway and stilling basin configurations. Data from the dissolved gas monitoring program is also being used to help refine existing regression-based and deterministic dissolved gas models.

In many districts, compliance with the Clean Water Act (e.g. NPDES — National Pollutant Discharge Elimination System, and Section 404(b)(1) evaluations) is managed under the water quality program. Although most division and district water quality elements have no

direct regulatory responsibility, their annual reporting requirements are more extensive than those of other functional elements.

2.2.1. Assigned Responsibilities

2.2.1.1. Northwestern Division

At the regional level, the Water Quality Unit (WQU) in the Reservoir Control Center (Water Management Division, Directorate of Programs) provides technical and policy guidance on CENWD-NP's water quality programs. The WQU is responsible for monitoring the TDG and water temperature conditions in the forebays and the tailwaters of the lower Columbia River/ lower Snake River dams, and selected river sites. The operational water management guidelines are to set spill levels at the dams (daily if necessary) so that the river waters are close to, but do not exceed State Water Quality Standards. This team also addresses variances from the total dissolved gas water quality standard with the appropriate States and tribes impacted by the program implemented in the Federal Columbia River Power System (FCRPS) for which the Corps has responsibility. As a long-term strategy, the Corps opened discussions with the State of Washington about replacing the year-to-year variances with long-term variances. The Corps already has in place a long-term variance from the State of Oregon that runs through the 2007 spill season.

Coordination also extends to other water quality programs and activities by the Corps, other agencies and regional organizations.

- ✓ The WQU staff directly coordinates and schedule short- and long-term reservoir operations for water quality that impact fish passage and fishery research.

- ✓ The WQU prepares a dissolved gas Plan of Action each year. It is a supporting document for the Regional Forum Technical Management Team, which makes recommendations on the operation of the Federal Columbia River Power System for multi-purpose use. The Plan stipulates what to measure, how, where, and when to take the measurements and how to analyze and interpret the resulting data. The Plan also provides for periodic review and alteration or reduction of efforts when monitoring results and/or new information from other sources justifies a change.

- ✓ The WQU represents the Corps as active participants in the Regional Forum Water Quality Team, which is expanding to address regional TMDL issues.

- ✓ The WQU is responsible for preparing an annual TDG Annual Report for distribution to the region, after review and synthesis of materials submitted by the districts.

- ✓ The WQU is responsible for updating the Water Quality Plan for Total Dissolved Gas and Water Temperature in the Mainstem Columbia and Snake Rivers. This report describes both the short-term and long-term plans for the reduction of TDG and management of water temperatures.

2.2.1.2. Districts

At the district level, all three NWD-NP districts are assigned broad responsibilities in developing and implementing water quality management programs. Districts are responsible for identifying and monitoring the sources of water quality problems associated with their projects. They inform State and Federal agencies of water quality changes that could present a public health hazard. They report emergency events to the Division's Readiness Management (Operations, Construction & Readiness Directorate). Some of their water quality activities overlap with other programs, such as the Defense Environmental Restoration Program and EPA Superfund Program. Water quality problems that can be resolved through reservoir operations are reported to the Reservoir Control Center for appropriate actions.

Primary responsibility for reservoir water quality programs usually rests with the planning and engineering elements. This is true for the Portland and Seattle Districts. In Walla Walla District, the Engineering H&H Branch and Operations Division's Natural Resources Management manages water quality. The H&H Branch also handles hazardous, toxic, and radioactive waste (HTRW) issues including ground water and sediment contamination with emphasis on contaminant identification. It provides water quality expertise and coordination for planning studies such as the Dissolved Gas Monitoring, Lower Granite Dredging Compliance Monitoring, Lower Snake River Project Water and Wastewater operation, and Public Health activities. The District Water Quality steering committee coordinates work with other districts and division as needed.

All NWD-NP districts have direct access to the COE Engineer Research and Development Center (ERDC) in Vicksburg, MS and the Hydrologic Engineering Center in Davis, CA for physical and mathematical modeling support. Each district reports its water quality activities annually to the Northwestern Division, North Pacific Region for review, synthesis, reporting and posting on the Internet.

2.2.2. Cooperation with Other Agencies

District and Division staffs routinely coordinate with Federal, State, and local agency environmental quality counterparts and state Department of Health for Public Services. The listing of twelve Pacific salmon species under the Endangered Species Act (ESA) has made this coordination critical since the Corps is responsible for the operation of its project for multiple purposes. All water users have a vested interest in what operation is being planned by the Corps, where, when, and how.

CENWD-NP's Reservoir Control Center (RCC), in the Water Management Division, plays an active role in implementing the flows measures contained in the NMFS's 2000 Biological Opinion. There is continual dialogue between RCC and the Pacific Salmon Coordination Office, the Bonneville Power Administration (BPA), utilities, state and federal fishery agencies and Indian Tribes. The RCC makes all final reservoir regulation decisions, frequently based on recommendations from the Technical Management Team, a mid-management level group set up by NOAA Fisheries in 1995 and chaired by the Corps representative.

NWW cooperates with the U.S. Department of Energy in analysis of existing data, development of GIS, and plans for future activities in water quality and fishery programs. Studies of sediment pollution for dredging activities are performed in cooperation with EPA and the Washington Department of Ecology. Coordination with the State of Washington Department of Ecology, State of Idaho Division of Environmental Quality (IDEQ), NOAA Fisheries, and ODEQ is performed for NPDES permitting activities. Contacts with IDEQ, State of Washington Department of Ecology, EPA, and U.S. Department of Energy are also needed to help address sediment transport and contaminant concerns.

2.2.3. National Corps Committees

CENWD-NP is represented on national Corps committees. These include the Corps' Committee on Water Quality (by CENWD-CM-WR-N), Committee on Tidal Hydraulics (by CENWS's Engineering), Corps Research and Development Field Review Group (by CENWD-CM-WR-N and CENWP-NP-ET-HR), and Committee on Hydrology (by CENWD-NP-ET-WH).

2.3. Major Goals And Objectives

Executive Order 12088, dated 8 November 1978 made it a national policy for the Federal Government to provide leadership in a nation-wide effort to protect and enhance the quality of air, water, and land resources. ER 1110-2-8154 (Water Quality and Environmental Management for Corps Civil Works Projects) dated 31 May 1995 establishes a policy for the water quality management program at Corps civil works projects. In accordance with this policy and additional guidance provided in NPDR 1110-2-101 ("Water Control Management, Water Quality") dated 19 December 1986, the established long-term goal of the Division's Water Quality program is to ensure that waters at each project are of suitable quality for the project's established project use(s).

To meet this goal, there is a need to:

- ✓ Develop a good understanding of the physical processes affecting water quality, including relationship between project operations and ambient water quality conditions; and

- ✓ Monitor water quality trends and current conditions so that future conditions can be reliably predicted and efficient corrective actions taken.

In order to achieve these objectives, there is a need to:

- ✓ Maintain staff capability in state-of-the-art water quality techniques and procedures, and correct application thereof;

- ✓ Implement reliable and adequate monitoring programs to support water management functions in an efficient and expeditious manner;

- ✓ Provide a comprehensive, up-to-date, and easily accessible data base; and

- ✓ Foster close cooperation with other Federal, State, and local agencies involved in water quality programs.

Objectives set by each district reflect the district's own priorities and requirements. These objectives and a summary of their status for FY02 are listed in the following sections.

2.3.1. Northwestern Division Objectives

2.3.1.1. Water Quality Objectives for FY2003

1. Continue to monitor and adjust spill levels at Corps projects in the Columbia River Basin during the spill season to maintain levels below the state standards for TDG (115% in the forebays and 120% in the tailraces) and temperature (68F);

2. Work with appropriate State water quality agencies to resolve state water quality issues; including obtaining/maintaining water quality exemptions.

3. Continue to improve Division-District coordination on water quality and related issues; develop an inter-agency Water Quality Plan for the Columbia/Snake system.

4. To provide an organized, coordinated approach to improving water quality, with the long-term goal of meeting water quality standards that the states and Tribes can integrate into their water quality management programs.

5. Participate in the development of a CENWD – North Pacific Water Quality Team to provide regional program management guidance.

6. Develop and implement 1-year and 5-year Water Quality Plans as specified in the 2000 NMFS BiOp.

7. To achieve the objectives of the NMFS 2000 BiOp.

2.3.1.2. Water Quality Status for FY2003

Objective 1. The Corps total dissolved gas and water temperature monitoring now includes deployment of 27 fully automated instruments at both forebay and tailwater areas of all Corps mainstem dams and other river locations. Division staff continues to coordinate the monitoring program on a system-wide basis, prepare real-time data reports, disseminate relevant information, and store the information in a permanent database.

Objective 2. Monitor and adjust spill levels, information collected through the dissolved gas monitoring program was used by the Inter-agency Technical Management Team on a real-time basis for adjusting project spill in an attempt to control total dissolved gas levels to the State standards. A spill and dissolved gas management policy was formulated and implemented annually division-wide. As was the case in the previous five years, NOAA Fisheries required that spill be implemented at lower Columbia and lower Snake rivers mainstem dams to improve juvenile passage conditions.

Objective 3. Project operational information, including fixed monitoring station data (TDG and temperature), is published real time on the TMT web page to aid regional decision makers. Monthly historical summaries of the FMS data are also published on the TMT web page.

Objective 4. Actively participate in regional forums dealing with water quality issues. Coordinate with EPA, the states and tribes in the development of mainstem TMDLs.

Objective 5,6 & 7. Division staff closely coordinated with all three Districts in many areas, including TDG monitoring scheduling special reservoir operations for TDG-related research.

2.3.2. Portland District Objectives

2.3.2.1. Water Quality Objectives for FY2003

1. Continue to operate and maintain stream-gaging programs in the Willamette and Rogue River Basins, Oregon, Willow Creek basin, and in Toutle River basin, Washington, and in the Lower Columbia River main stem. Upgrade some of the Willamette gages to obtain temperature data to support DEQ TMDL modeling efforts.

2. Work with Oregon resource agencies to develop instream-flow rules for the Willamette River requiring the Corps of Engineers to provide specific flows year-round for fisheries and water quality enhancement.

3. Continue coordination with resource agencies to assure Portland District's compliance with Federal and State water quality regulations at existing and proposed Federal projects.

4. Develop study plan for RAMS program and seek funding for Black Butte mine in the watershed of Cottage Grove Reservoir. Continue studies of mercury contamination in Cottage Grove and Dorena Reservoirs.

5. Continue selective withdrawal at Willow Creek Reservoir to aid locals in reducing temperatures in Willow Creek below the project.

6. Complete installation of aeration equipment at Willow Creek Reservoir to improve water quality by reducing H_2S and methane production.

7. Review historic and current data to determine problem specific water quality studies to conduct at Corps projects.

8. Continue to implement the District Fixed Monitoring Program (FMP) for monitoring TDG in the forebays and tailwaters of Corps Projects in the lower Columbia River (including the Warrendale and Camas/Washougal sites). Evaluate the need for dropping and/or moving FMP sites to improve the programs goal of monitoring compliance with water quality standards.

9. Continue to monitor TDG at Corps Projects in the Willamette and Rogue Basin on an as-needed basis.

10. Continue to participate with the U.S.F.S. and the city of Salem as a team member to monitor water quality in the North Santiam Watershed.

11. Implement plans and specifications for water quality monitoring during construction of the Selective Withdrawal Tower at Cougar Reservoir and Blue River Reservoir.

12. Continue to support efforts to set up water quality models of District Projects that have important water quality problems.

13. Support the State and EPA in developing TMDLs for the Willamette and Columbia River.

14. Continue participation in developing a Water Quality Plan for District projects in the Lower Columbia River as required in the NMFS Biological Opinion on saving threatened fish species.

2.3.2.2. Water Quality Status for FY2003

Objectives 1 through 5, 7-8, and 10-14 in 2003 were met.

Objective 6 was partially met. Aeration equipment for Willow Creek Reservoir was purchased and will be installed in Spring of 2004.

Objective 9 did not apply as there was no need for gas monitoring at Willamette Projects in 2003.

2.3.2.3. Sediment Quality Objectives for 2003

1. Continue water/sediment quality monitoring during construction of the Selective Withdrawal Tower at Cougar Reservoir.

2. Continue the District-wide sediment quality evaluation program at Operations and Maintenance dredging projects. During FY 2004, sediment quality evaluations will be conducted in the Columbia River, Lower Willamette River, Coos Bay, Yaquina River, Bonneville Dam Fish Rack, and additional federal projects, as funded. Update annual Sediment Evaluation Summary Report.

3. Continue coordination with resource agencies to assure Portland District's compliance with Federal and State water quality regulations at existing and proposed Federal navigation projects.

4. Continue to advise the Regulatory and Environmental Resource Branch (CENWP-EC-R) on testing procedures and interpretation of results for Section 404/103 permit actions.

5. Continue to develop management/monitoring plans and implement the management/monitoring programs for ODMDS.

6. Continue to participate in development of regional dredging teams as defined in the December 1994 MARAD report by the implementation and updating of the Dredge Material Evaluation Framework for the Lower Columbia River Management Area, converting updated manual to a true Regional Testing Manual, for sediment quality evaluation through the regional Sediment Evaluation Team (RSET). Updated manual will be re-named Sediment Evaluation Framework.

7. Continue populating and managing the SEDQUAL database.

8. Complete ODMDS evaluation study and Section 103 selection for 2 new ODMDS at MCR for 2003.

2.3.2.4. Sediment Quality Status for FY2003

Objectives 1-4. Sediment quality evaluations, standard compliance, and ODMDS studies were fully achieved for FY 2003 goals, with effort continuing in FY 2004.

Objective 5. Management and monitoring of ODMDS programs. Annual bathymetric surveys were completed at the ODMDSs. .

Objective 6. Participation in regional dredging teams is an on-going activity. A team consisting of Corps, EPA, NOAA Fisheries, USFWS, ODEQ, WDOE and WDNR representatives is charged with updating (DMEF) guidelines for regional dredging activities.

Objective 7. SEDQUAL is an ongoing effort.

Objective 8. Completed

2.3.3. Seattle District Objectives

2.3.3.1. Water Quality Objectives for FY2003

1. Continue performing project and related data evaluation and reduction.

2. Continue development and application of an operational water temperature model for Libby Dam to aid in determining the effects of temperature on the Kootenai River white sturgeon.

3. Continue limnological and routine water quality sampling of Lake Koocanusa, Howard Hanson Reservoir, the Kootenai River, and the Green River.

4. Continue automating data collection capabilities with emphasis on the Lake Washington Ship Canal.

5. Continue maintenance and updates to the Dredged Analysis Information System (DAIS).

6. Continue to evaluate joint operations of Grand Coulee and Chief Joseph Dam to reduce TDG in Lake Rufus Woods. Finalize a feasibility study of joint operations and provide recommendations to the Technical Management Team.

7. Continue to evaluate total dissolved gas management measures at Libby Dam, including installing at least one new generating unit, to allow high flows with reduced risk of spill and high TDG levels.

8. Perform a total dissolved gas exchange study at Albeni Falls Dam and the Pend Oreille River during all spill conditions.

9. Continue the water column temperature study at Chief Joseph Dam to evaluate water temperature increases in Lake Rufus Woods between Grand Coulee Dam and Chief Joseph Dam.

10. Continue the water column temperature study at Libby Dam to evaluate water temperature stratification in the forebay from spring through fall.

11. Continue the water quality sampling program at Howard Hanson Reservoir to evaluate possible water quality changes from the Additional Water Storage Project.

12. Implement a total dissolved gas management study at Libby Dam to evaluate ways to reduce TDG levels in the Kootenai River below Libby Dam during spill.

13. Implement a water quality study at Chief Joseph Dam to characterize the quality of relief tunnel and forebay waters to determine if these water sources meet water quality criteria for use at a proposed Colville Tribe fish hatchery.

2.3.3.2. Water Quality Status for 2003

Objective 1 (Data evaluation). Efforts were made to continually re-evaluate and enhance the District's water control data collection system. A cooperative data collection program was continued with the U.S. Geological Survey.

Objective 2 (Libby water temperature monitoring). The District continues to use and refine a numerical model to assist a multi-agency recovery team in planning Libby Dam releases that would benefit sturgeon larval releases from the Kootenai Indian Tribe’s fish hatchery.

Objective 3 (Routine sampling at Lake Koocanusa and Howard Hanson Reservoir). The District monitored water quality in Lake Koocanusa and the Kootenai River at 3 in-reservoir stations from April through October and 1 downstream station from January through December. The District monitored water quality in Howard Hanson Reservoir and the Green River at 1 upstream station, 6 in-reservoir stations, and 1 downstream station.

Objective 4 (Data collection on Lake Washington). The District continued operation of 5 water quality stations in the Lake Washington Ship Canal (LWSC) in 2003. All stations transmit real-time data to the District's Reservoir Control Center. The LWSC data are used to make operational decisions for control of saltwater intrusion.

Objective 5 (Dredge Analysis). The Dredged Analysis Information System (DAIS) is used to manage data used in the assessment of sediment quality for regulated and federal operations and maintenance projects.

Objective 6 (TDG issues at Chief Joseph Dam). The District continues to participate in interagency discussion to develop solutions to dissolved gas problems above and below Chief Joseph Dam. A study that evaluated joint operations of Chief Joseph Dam and Grand Coulee Dam was completed in 2003. The study concluded that joint operations could lower TDG in Lake Rufus Woods. The District presented the results to the Technical Management Team, who then incorporated the result into the water quality plan.

Objective 7 (New Turbine Unit at Libby). The District continues to provide information to outside agencies that are exploring power unit installation as a means of reducing the risk of spill and high TDG levels at Libby Dam.

Objective 8 (TDG exchange study at Albeni Falls). The District performed a TDG exchange study at Albeni Falls Dam. Monitoring at Albeni Falls Dam consisted of measuring TDG at eleven different locations: 3 in the forebay, 3 immediately below the dam, and 5 approximately 1.6 miles below the dam during spill that occurred from May 1 through June 30, 2003.

Objective 9 (Temperature study at Chief Joseph Dam). The District completed a temperature study at Chief Joseph Dam during 2003. Temperature strings were placed at three locations in Lake Rufus Woods between Grand Coulee Dam and Chief Joseph Dam from June through October 2003.

Objective 10 (Temperature study at Libby Dam). The District completed a temperature study at Libby Dam during 2003. A single temperature string was placed at the forebay of Lake Koocanusa from April through November 2003.

Objective 11 (Limnological study of Howard Hanson Reservoir). The District continued an annual limnological study of Howard Hanson Reservoir to determine the possible water quality impacts of storing additional water in the reservoir during the summer months. This study will continue in 2004.

Objective 12 (TDG management study at Libby Dam). The District conducted a feasibility assessment of structural and operational alternatives that could potentially reduce the amount of TDG in the Kootenai River below Libby Dam.

Objective 13 (Colville Tribe fish hatchery). The District conducted a study to determine the water quality of several potential water sources for a proposed Colville Tribe fish hatchery at Chief Joseph Dam.

2.3.4. Walla Walla District Objectives

2.3.4.1. Water Quality Objectives for FY2003

Objective 1. Organize the Hydrology water and wastewater computer site and update all water and wastewater compliance testing, record keeping and information. Manage water and wastewater systems at Little Goose and Lower Granite Dams.

Objective 2. Identify personnel needs required to monitor and operate District water and wastewater plants.

Objective 3. Pursuant to RPA-114 of the 2000 FCRPS Biological Opinion provide assistance to biologist for comprehensive investigation of depth and temperature in the fish passage system and the project near field to determine potential passage problems and facilitate other model and temperature investigations.

Objective 4. Pursuant to RPA-132 of the 2000 FCRPS Biological Opinion provide technical assistance to Mr. Randy Chong for the comprehensive review of the dissolved gas monitoring stations in the Walla Walla District and provide recommendations for implementation of remedial actions. Special attention will be given to correcting thermocline related problems associated with the forebay monitors. The District will continue to operate the TDGMS to provide the region with the highest quality data obtainable within the annual O&M budgeted appropriation line item.

Objective 5. Pursuant to RPA-143 of the 2000 FCRPS Biological Opinion (dated 21 September 2000), provide technical assistance to Mr. Randy Chong with quality temperature monitoring data for use in all present and future modeling studies. In addition, all data collection efforts will be conducted under a peer reviewed SAP and undergoes a rigorous QA/QC procedure to optimize its usefulness to all interested parties.

Objective 6. Complete the new submerged high-density polyethylene pipe sonde deployment systems for all tailwater TDG stations. Improve TDG system capability with improved precision barometers and sondes.

Objective 7. Design and conduct a sediment sampling study for proposed 2003/2004 dredging. Provide level 2 QA/QC assurance for the study. Conduct additional chemical analysis. Provide baseline data. Evaluate parameters for a dredge framework.

Objective 8. Add new information to the sediment database and conduct a physical and chemical evaluation for habitat management decisions. Test for new herbicide and pesticide compounds that may be in agricultural use in the area.

Objective 9. Conduct baseline limnological studies. Evaluate parameters effecting both water quality and aspects of fish life cycles.

Objective 10. Provide velocity data and bathymetry information to evaluate sedimentation and provide habitat mapping.

2.3.4.2. Water Quality Status for FY2003

Objective 1. All water and wastewater testing was brought up to compliance. A Hydrology water and wastewater site on the S-drive computer site has log sheets and Discharge Monitoring Reports (DMR) that provide electronic backup documentation. All testing reports will be scanned. Existing reports include more than 3 years of data that will be necessary for new permit information.

Objective 2. Equipment was provided for testing. Operational controls were improved. Recommendations were made to improve effluent quality. Continued informational assistance will be provided to field project personnel regarding testing and system operation.

Objective 3. Sampling is described in this Water Quality Report. Sampling was supplemented by data from Hydrology studies using thermister strings and sondes at forebay and near forebay areas. Laboratory equipment and Onset® temperature loggers were provided based on availability.

Objective 4. A report was generated for the TDG forebay fixed monitoring station review project in McNary and the Lower Snake River. Recommendations were made that can improve representativeness of monitors. Buoy thermister units provided portable temperature monitoring stations with real time data telemetry and transmission capability.

Objective 5. A report on the forebay and tailwater water temperature modeling and data collection plan study is due in the spring of 2004. Data continues to be collected to support real time operational use of a temperature model. Additional study phases are planned for temperature sampling in both up and downstream areas in an attempt to optimize temperature regimens in the Lower Snake River.

Objective 6. All project TDG tailwater sites are now complete with HDPE submerged pipe deployment system. Minor modification will have to be made to the anchoring systems at Anatone, Peck and Ice Harbor. New sondes and barometers will be evaluated starting with the Pasco station.

Objective 7. The dredge study was completed at historical dredge template sites. The study also included tests for additional sampling areas and analysts tested for. The sampling protocols and laboratory work were validated at level 2 QA/QC by Kismet Scientific services.

Objective 8. An extensive list of pesticides was tested for in 2003 including carbonate and urea pesticides groups in; the sediment sampling for 2003/2004 proposed dredge study, woody riparian sediment sampling and Bennington Lake sediment sampling. This data will

be important as historical baseline information for the region and in making future dredge framework decisions.

Objective 9. Limnological investigations were made in the lower Snake River, Lake Wallula, Mill Creek, Bennington Lake and Pasco Pumping Pond. Temperature was recorded in all forebays and sites adjacent to forebays. Several mid pool sites were also monitored for temperature.

Objective 10. Velocity, temperature and bathymetry were recorded by acoustic doppler profiling at six Lower Snake River sites; two were in the reservoir above Ice Harbor Dam and four in the reservoir above Little Goose Dam. Two additional areas above Lower Monumental Dam will be sampled in 2004.

2.4. Laboratory and Field Equipment

2.4.1. Northwestern Division

No laboratory facilities or activities.

2.4.2. Portland District

1. No laboratory facilities.

2. The USGS laboratory at the Water Resources Division was used for calibration, maintenance and repair of TDG saturometers and DCPs for the Fixed Monitoring Stations (FMSs).

3. Analysis equipment available for routine water quality monitoring include 3 Hydrolab multi-probe water quality samplers (containing one or more of the following probes: total dissolved gas, turbidity, conductivity, pH, dissolved oxygen, temperature, depth), 3 TDG saturometers (installed and maintained by the USGS), Orion pH, dissolved oxygen and conductivity meters, Hach turbidity meters, and NIST certified thermometers and barometers. Sampling equipment available includes vertical point water samplers, a Ponar sediment sampler, a box corer, and a gravity corer. A __ft-john boat is available for reservoir work.

4. The Portland District uses several environmental contractors to obtain field samples for water quality and sediment quality sampling and analysis. A partial list of these contractors includes Hart Crowser Inc., Cascade Research Group, Aquatic Analysts, Inc., USGS Oregon District, and the COE Engineer Research and Development Center (ERDC).

2.4.3. Seattle District

1. The Seattle District continues to use a variety of environmental contractors to obtain field samples for water quality and sediment quality sampling and analysis. A partial list of these contractors include Aquatic Research, Tetra Tech, HDR, R2 Resource

Consultants, Economic and Engineering Services, Montgomery Watson Harza, D.M.D., Inc Environmental and Toxicological Services, Montana Environmental Laboratory, University of Arizona, USGS, and the COE Engineer Research and Development Center (ERDC).

2. The Seattle District maintains its own on-site laboratory for the collection and analysis of water and sediment samples. Analysis equipment available includes Hydrolab multi-probe water quality samplers (containing one or more of the following probes: total dissolved gas, turbidity, conductivity, pH, dissolved oxygen, temperature, depth), Orion pH, dissolved oxygen and conductivity meters, Hach turbidity meters, Vemco temperature loggers, and NIST certified thermometers and barometers. Sampling equipment available includes vertical point water samplers, a Ponar sediment sampler, and a simple plankton net. In addition, each project in the Seattle District operates and maintains sampling boats equipped with winches and depth sounders. The on-site laboratory is equipped to handle the calibration of field instruments and the QA/QC of total dissolved gas and temperature instruments. The laboratory has equipment to maintain and repair Hydrolab and Orion sampling equipment. In addition, the laboratory has sieves and ovens for sediment analysis.

2.4.4. Walla Walla District

1. Walla Walla District maintains the capacity to collect water and sediment samples throughout the Division. Equipment available includes:

    a. A two-man canoe.
    b. An18-ft river jet boat.
    c. One 23-ft, GPS equipped aluminum work vessel.
    d. A Ford F350 super duty service body truck (GSA).
    e. Two acoustic Doppler profilers.
    f. Over fifty water quality multi-probe profilers.
    g. Comprehensive groundwater sampling apparatus, including submersible pumps, plus biological sample and analysis equipment.
    h. Sediment Ponar and core samplers, winches and other related instruments and equipment.

2. Walla Walla District enhanced the capability of its modest water quality laboratory facility. Features include:
    a. Calibration of field instruments and completion of necessary QA/QC for TDG instrumentation. A NIST certified barometer and certified pressure sources insure that the TDG instrumentation is kept at optimal performance.
    b. A comprehensive suite of equipment to maintain and repair Hydro lab®, YSI®, and TDG data collection equipment. A special 2-HP electric mixer for the constant water temperature bath is used during calibration and instrument evaluation.
    c. The water quality laboratory has the capacity to analyze nutrient samples for the district reservoirs. Parameters include phosphorus, nitrate, ammonia, sulfate, total nitrogen, chlorophyll *a*, plus selected anions and cations.

d. The laboratory can also support a variety of turbidity monitoring equipment in support of dredging and construction operations. A full complement of sieves, ovens, shakers, and cabinets allow for volume production of particle-size grain analysis along with other selected qualitative and quantitative sediment analyses.

3. The laboratory also monitors and maintains contracts for the analysis of metals and organic contaminants in support of District missions. The laboratory has detailed apparatus for the evaluation of most wastewater parameters. We have produced a hazardous waste and safety supply contract to support ECC operations at the projects.

4. The District acquired eighteen replacement barometers for the dissolved gas monitoring system this year. The new barometers are equipped to provide multiple SDI-12 output and are capable of providing pressure transducers with real-time differential corrections. The new barometers are accurate to one-tenth of a millimeter of mercury and are equipped with a digital display.

5. Twenty new sondes were purchased from Sweeny Aquametrics . These instruments will be used in the "redundancy" initiative. Some of these instruments will go towards replacing in-service sondes that require factory level repairs. The current plan is to meet the duplicate sonde requirement (plus spares) in FY 2004.

6. Additional temperature monitoring was also implemented. Onset Optical® temperature recorders were purchased for the water collection modeling and data collection plan and for replacement at historical sampling sites in Dworshak Reservoir. Additionally five new floatation pontoons were purchased. These and our other inventory of six pontoons will be equipped with temperature thermister strings and Sutrons for real time data and satellite transmission at project forebays. We currently have a requisition in place to procure a Digiquartz Portable Laboratory high precision Barometer.

2.5. Data Collection and Analysis

2.5.1. Northwestern Division

In January of 1996 the water quality collection activities in the Columbia River Basin were turned over to the district offices. The Northwestern Division, North Pacific Region serves as the data collection site for the real-time FMS data. The Northwestern Division, North Pacific Region, through the Water Quality Unit (WQU), Reservoir Control Center, Water Management Division continues to coordinate District data collection activities. Tasks performed included the following:

- ✓ Develop an annual plan of action in coordination with the Districts, including number and location of monitoring stations, quality assurance and quality control (QA/QC) protocols for data measurement, data coding and transmission, and instrument calibration and maintenance;

- ✓ Coordinate the start and end dates for the monitoring season;

- ✓ Monitor FMS data received, coordinate with responsible party when an FMS mal-functions, fill data gaps and correct data in the water quality copy of the CROHMS data set which is used for water quality reporting;

- ✓ Prepare daily reports on dissolved gas saturation, water temperature, project spill, pool elevations and total flow;

- ✓ Perform statistical analyses and computer modeling to refine site-specific or system-wide spill versus TDG relationships;

- ✓ Hold pre- and post-season reviews of Corps monitoring activities with regional participation to discuss details of monitoring activities, receive comments and recommendations and plan for future changes and improvements; and

- ✓ Prepare an annual report on the FMS performance with a discussion of the current year's operations, and recommendations for next year's activities.

The WQU staff also posted information to the regional Technical Management Team (TMT) homepage for dissemination to regional users and researchers, as well as coordinating reservoir regulation details for data collection below Corps projects. The Plan of Action for TDG monitoring in 2003 was included in various documents, including the Corps' Fish Passage Plan and application package for state standard water quality waivers.

The annual TDG monitoring report prepared by the Division was based on information received from the district and division water quality staffs and the US Geological Survey. Refer to the Annual TDG Report for a summary of the FMS Program.

2.5.2. Portland District

1. Applegate and Lost Creek Lakes.
   For a second year John Salinas of Cascade Research Group collected water temperatures at various locations up to 40 miles downstream of the Lost Creek and Applegate projects in the Rogue and Applegate rivers. The purpose is to determine the distance downstream that the projects can influence water temperatures under normal flow conditions. Additionally, water samples were taken late in the summer from the Rogue River below Lost Creek dam. These were analyzed for geosmin and MIB to determine if taste & odors were present in the water.

2. Hills Creek.
   The lake was temporarily posted this summer with a warning advise against prolonged contact with water in certain sections of the lake where blue-green algae cell densities exceeded 15,000 cells/ml.

3. Cougar Lake.
   The USFS collected hydrolab profile data at three lake stations (1 though 3) on a monthly basis from December to March and collected the profile data every two weeks

from April to November. The USGS collected temperature and turbidity data from the USGS gaging station located upstream of the Cougar project (gage 14159500) and temperature, turbidity, dissolved oxygen (DO), and DO percent saturation from the USGS gaging station located downstream of the Cougar project (14159500). The data was continuously collected and reported the parameters as an average over every half hour.

4. Willow Creek Lake.
In situ water quality data were collected monthly in August, September and October. In situ measurements for dissolved oxygen, pH, specific conductance, and temperature were taken in the water column with a Hydrolab H20 instrument. Water grab samples were collected at various depths in the water column. Samples were analyzed for dissolved oxygen, chlorophyll a, nutrients, ammonia, fecal coliforms, TSS, TDS, organic carbon, silica, manganese, iron, sulfide and sulfate. The same analyses were performed on incoming and release water samples.

Two reports will be prepared summarizing the data collection efforts. One report will detail methane production characteristics of the lake and the report will discuss the ecology of algae in the lake.

In September the District purchased aeration equipment that will be set up in the spring of 2004 to aerate the lake.

5. Elk Creek.
Water temperatures and turbidity were recorded hourly by the USGS at four monitoring sites (Trail, Cascade Gorge, and Alco Creek) on Elk Creek in the Rogue River Basin, Oregon. This work continues a database useful for assessing water quality impacts resulting from the partially completed Elk Creek Dam.

6. Detroit Lake.
The District, City of Salem and USFS began routine monitoring of turbidity in the fall of 1998. The District entered into an agreement with its partners to cooperate in this effort. Monitoring according to the agreement continued this year.

7. TDG Fixed Monitoring Program (FMP).
TDG was measured from mid-March through mid-September for most stations at District projects on the lower Columbia River. A total of 8 instruments were assigned to forebay, tailwater, and downstream stations for John Day, The Dalles and Bonneville Projects. Two experimental sites, one at the navigation lock wing wall in the forebay of John Day dam and the other in the tailwater off Bradford Island below Bonneville dam, were set up during the spill season. The purpose of the John Day forebay site was to determine if it was a better location for obtaining gas data than the current site, which yields anomalous during hot summer days. The purpose of the Bradford Island site was to obtain a more direct measure of gas production associated with spill. Data was transmitted real time to the Division CHROMS database. This year less than 1 % of the data was lost. The data is important for monitoring compliance with state TDG

standards and impacts to fish. The Camas gage was evaluated for representativeness according to requirements of RPA132 of the NMFS Columbia River BiOP. Gas monitors were placed on a transect across the river from the Camas site as well as up and downstream. WES personnel performed this work.

8. Dredged Material Projects.
Sediment samples were obtained during FY 2003 at the following federal navigation projects and Study Projects: On the Columbia River: Bachelor Slough (RM 88-92), Skipanon Channel (RM 10.7), Astoria Turning Basin (RM 13), Mainstem Navigational Channel, Columbia River Mile (RM 10-13.5), Crims Island (RM 54), Old Mouth of the Cowlitz River (67.7) and Kalama Turning Basin (RM 73.9-74.8); on the Willamette River: Oaks Bottom (RM 16) and Mainstem Navigational Channel, Willamette River (RM 2 & 8.5-10); on the Yaquina River Depot Slough (RM 13).Bulk physical and chemical analyses were performed on samples to determine compliance with the Clean Water Act and the Marine Protection, Research and Sanctuaries Act, to determine suitable disposal options. Screening guidelines used, to implement these regulations, are those adopted for use in the regional manual, The Dredge Material Evaluation Framework (DMEF). Sediments were collected using various types of sampling equipment, including: boxcore surface sampler, gravity and vibra corers. Physical tests included particle-size distribution, percent volatile solids, void ratio, specific gravity, and re-suspended density. Sediments were also tested for priority-pollutant heavy metals, pesticides, dioxin/furan, PCBs (polychlorobiphenyls), PAHs (polynuclear aromatic hydrocarbons), organotin (TBT), TOC (total organic carbon), phenols, phthalates and miscellaneous extractables. DMEF Tier III, bioassay analyses were conducted as part of the pre-dredging characterization on the Lower Willamette River and Skipanon Channel projects; in addition, bioaccumulation tests were conducted on the Willamette River sediments.

2.5.3. Seattle District

1. Water quality monitoring at Chief Joseph Dam and Lake Rufus Woods consisted of real-time monitoring TDG and temperature at forebay and tailwater stations, and installing temperature strings at three locations in Lake Rufus Woods from Grand Coulee Dam to Chief Joseph Dam. Temperature strings consisted of Vemco data loggers attached at various depths to a weighted cable and secured in place with an anchor and buoy. Temperature was recorded every hour from June through October 2003.

2. Water quality monitoring at Libby Dam and Lake Koocanusa continued during 2003. Water quality grab samples were collected at monthly intervals in Lake Koocanusa at three stations between the international border and the forebay from April through November. Samples collected from the epilimnion and hypolimnion were analyzed for conventionals, nutrients, and metals. A composite sample from the photic zone was analyzed for chlorophyll a and algae. Vertical profiles of temperature, conductivity, pH, and dissolved oxygen were also recorded at each station. A downstream station on the Kootenai River was monitored at monthly intervals from January through

December, with samples being analyzed for conventionals, nutrients, and metals. A temperature string was set up in the forebay. The string consisted of Vemco data loggers attached to a weighted cable. The temperature string logged hourly temperature at various depths between the surface and bottom of the reservoir.

3. A TDG exchange study was conducted at Albeni Falls Dam. Monitoring consisted of measuring TDG at 11 locations – 3 in the forebay, 3 immediately below the dam, and 5 about 1.6 miles below the dam during spill that occurred from May 1 through June 30, 2003. The purpose of the study was to define and quantify processes that contribute to dissolved gas transfer during spill releases at Albeni Falls Dam. The study focused on resolving questions regarding accurate source and sink descriptions of mass conservation of dissolved gases in the Pend Oreille River below the dam.

4. Water quality samples were collected during the Additional Water Storage Project test pool at Howard Hanson Reservoir from April through October 2003. The goal of the monitoring program was to characterize the water quality of Howard Hanson Reservoir during the test pool to determine if water quality impacts are occurring during elevated reservoir storage conditions. Specifically, there is concern about the potential for increased reservoir elevations to lead to increased concentrations of nutrients, organic matter, and phytoplankton in the reservoir. To meet the project goals, water quality was monitored in the Green River and Howard Hanson Reservoir during the test pool. Water quality parameters of concern for Howard Hanson Reservoir include temperature, dissolved oxygen, nutrients (i.e. phosphorus and nitrogen), organic matter, chlorophyll a, and phytoplankton. Additional water quality parameters such as pH, conductivity, and alkalinity were monitored to help with the basic understanding of the limnology of the reservoir. Sampling consisted of collecting monthly grab samples from the epilimnion and hypolimnion and conducting vertical profiles for temperature, pH, conductivity, and dissolved oxygen at bi-weekly intervals.

5. Real-time water quality monitoring continued at many District projects, including the Lake Washington Ship Canal. Real-time water temperature, conductivity salinity, dissolved oxygen, and TDG data were transmitted to the District and Northwestern Division, North Pacific Regions. These data were supplemented by field turbidity measurements at Howard A. Hanson and Mud Mountain projects. The automated salinity sensors installed in the Lake Washington Ship Canal were ground-truthed periodically to ensure accuracy.

6. During the summer conservation season, additional water quality data were collected at Howard A. Hanson reservoir and the Lake Washington Ship Canal. In-situ measurements of temperature, dissolved oxygen, pH and specific conductivity were collected at various depths in the water column. The City of Aberdeen collected similar data for Wynoochee reservoir and furnished copies of the data to the District. The data were used to monitor reservoir thermal stratification at Wynoochee and Howard A. Hanson reservoirs and saltwater intrusion and dissolved oxygen concentration in the Lake Washington Ship Canal.

7. Seasonal water quality monitoring data is collected at one station in the East Bay Marina, Olympia Harbor, in South Puget Sound. Data is reviewed to determine when the Port of Olympia must operate its mechanical aeration system to increase dissolved oxygen levels to levels that are not harmful to fish.

8. Maintenance dredging sediment quality evaluations were performed on the Duwamish River Turning Basin and on the lower Snohomish River Navigation Channel sediments.

9. Disposal Site Monitoring was conducted at the Commencement Bay open-water dredged material disposal site. This involved physical mapping of the dredged material footprint at the site with Sediment Profile Imagery. The monitoring included an analysis of sediment chemistry, sediment bioassays, chemical analysis of benthic tissues and an analysis of benthic community structure and abundance.

10. A real-time TDG station was set up at the tailwater of Libby Dam. TDG was monitored hourly in the forebay and tailwater of Chief Joseph Dam and in the tailwater of Libby Dam according to specifications in the 2000 NMFS Biological Opinion. Data was transmitted to the CROHMS database.

11. Water samples were collected at the relief tunnel and forebay of Chief Joseph Dam for a proposed Colville Tribe fish hatchery. Water quality parameters of concern include nutrients, metals, and pesticides.

2.5.4. Walla Walla District

1. Drinking water was sampled monthly for coliform bacteria at Little Goose and Lower Granite Dams. Additional tests were performed for organic and inorganic substances to meet monitoring requirements.

2. Wastewater was also sampled at Little Goose and Lower Granite Dams in accordance with the NPDES permit requirements. Discharge Monitoring Reports that include effluent loading and quality were prepared monthly and mailed quarterly to the EPA. Additional engineering tests were performed at the Hydrology lab in Walla Walla to improve project wastewater processes. Recommendations were made and procedures implemented to improve compliance with permit criteria.

3. Total Dissolved Gas was monitored hourly at sixteen stations located in the forebay and tailwater of District projects to determine gas levels resulting from various project spill events. Data were transmitted to the CROHMS database.

4. Temperature loggers were used to collect data in the adult fish ladders and in the juvenile system at the Walla Walla District projects during the summer and fall. The loggers were attached to a rope and lowered to approximately one foot from the bottom. The data loggers were set to record water temperature once per hour. The project biologists download the data to a shuttle. The district fish biologist completed a phase I report under RPA 114 that details physical characteristics and temperature regimes at the fish facilities throughout the year.

5. A variety of water quality and limnological samples were collected at sites in McNary Reservoir, the Lower Snake and Clearwater Rivers. Parameters tested include temperature, oxygen, pH, conductivity, alkalinity, ammonia, nitrate, phosphorus and chlorophyll. Zooplankton and phytoplankton samples were also taken.

6. TDG, water temperature and depth were recorded with multiprobes and sensors at McNary and Lower Snake River forebay sites.

7. Onset StowAway® temperature loggers were used to collect data at forebay and tailwater dam sites to support temperature model development.

8. Sediment was sampled for an environmental reconstruction project at Martindale Island, a cultural site in the Lower Snake River.

9. Onset OpticStowaways® were used to log temperatures at Mill Creek and Bennington Lake over a four-month period. Sediment was analyzed from Bennington Lake for grain size, inorganic constituents and an extensive pesticide and herbicide list. Field limnological data was recorded and water samples were analyzed for suspended solids, particle size, nutrients and alkalinity.

10. Written responses and technical support to water quality related comments were provided for the DMMP (Dredge Material Management Program) and the Sediment Evaluation Addendum.

11. Sediment was sampled for particle size analysis at the upstream end of Eagle Island in the Boise River. Six samples were from the river and two were taken from sediment stockpiles.

12. Sediment was sampled for metals, pesticides and petroleum products in the Lindsay Creek diversion structure at the Lewiston Levy.

2.6. Water Quality Reports

2.6.1. Northwestern Division

Annually the Northwestern Division, North Pacific Region publishes this comprehensive report and a separate report for Total Dissolved Gas Monitoring in the Columbia Basin.

2.6.2. Portland District

1. Tanner, D.Q., Johnston, M.W., and Bragg, H.M., 2003, Total Dissolved Gas and Water Temperature in the Lower Columbia River, Oregon and Washington, 2003. U.S. Geological Survey Water-Resources Investigations Report 03-4306.

2. Sherman T. J., 2003, U. S. Army Corps of Engineers, Portland District. Bachelor Slough Astoria Turning Basin, Sediment Quality Evaluation.

3. Sherman T. J., 2004, U. S. Army Corps of Engineers, Portland District. Skipanon Channel, Sediment Quality Evaluation.

4. Sherman T. J., 2003, U. S. Army Corps of Engineers, Portland District. Astoria Turning Basin and Mainstem Navigational Channel, RM 10-13.5, Sediment Quality Evaluation.

5. Sherman T. J., 2003, U. S. Army Corps of Engineers, Portland District. Crims Island, Sediment Quality Evaluation.

6. Sherman T. J., 2003, U. S. Army Corps of Engineers, Portland District. Old Mouth of the Cowlitz River, Sediment Quality Evaluation.

7. Briner W., Sherman T. J., 2003, U. S. Army Corps of Engineers, Portland District. Kalama Turning Basin, Sediment Quality Evaluation.

8. Hart Crowser, Inc., 2004, US Army Corps of Engineers. Willamette River Dredging Characterization Study.

9. Siipola M.D., U.S. Army Corps of Engineers, Portland District. Bonneville 2nd Powerhouse Fish Units Trash Rack., Tier I Sediment Quality Evaluation.

10. U.S. Army Corps of Engineers, Portland District. Final Supplemental Investigation Report (SIR), Willamette Temperature Control, McKenzie Sub-Basin, Oregon, Cougar Dam and Reservoir; August 2003.

2.6.3. Seattle District

1. U.S. COE. 2003. Preliminary scope of Work: Water quality sampling at Chief Joseph Dam for the Colville Tribe fish hatchery. U.S. Army Corps of Engineers, Seattle District.

2. U.S. COE. 2003. Lake Washington Ship Canal Water Quality Monitoring and Analysis Plan. U.S. Army Corps of Engineers, Seattle District.

3. U.S. COE. 2003. Howard Hanson Reservoir sampling and analysis plan. U.S. Army Corps of Engineers, Seattle District.

4. U.S. COE. 2003. Chief Joseph Dam sampling and analysis plan. U.S. Army Corps of Engineers, Seattle District.

5. U.S. COE. 2003. Albeni Falls Dam total dissolved gas exchange study sampling and analysis plan. U.S. Army Corps of Engineers, Seattle District.

6. Easthouse, K.B. 2003. Assessment of increased river flows on ground water quality in wells adjacent to the Kootenai River, Montana. U.S. Army Corps of Engineers, Seattle District, Seattle, WA.

7. Easthouse, K.B. and A.S. Klein. 2003. Total dissolved gas and temperature monitoring at Chief Joseph Dam, Washington and Libby Dam, Montana 2003: Data review and quality assurance. U.S. Army Corps of Engineers, Seattle District.

8. Schneider, M. and J. Carroll. 2003. Total Dissolved Gas Exchange at Libby Dam June – July 2002. Final report prepared for the U.S. Army Corps of Engineers, Seattle District by the U.S. Army Corps of Engineers, Engineer and Research Development Center (ERDC), Dallesport, WA.

9. Dredged Material Management Program Biennial Report for Dredging Years 2002 and 2003. Prepared by the Dredged Material Management Office.

10. Sediment Management Annual Review Meeting Summary – May 7, 2003. Prepared under contract for the Dredged Material Management Office and the Dredged Material Management Program Agencies.

2.6.4. Walla Walla District

1. Heaton, R.D., S. Juul, 2003. Physical and Chemical Characterization of Sediments in the Lower Snake River Proposed for 2003/2004 Dredging.

2. Carroll, J.H. TDG Forebay Fixed-Monitoring Station Review and Evaluation for the Lower Snake River Projects and McNary Dam Draft Report 2003.

3. Steve Juul co-authored a poster session titled ”Implications of Total Dissolved Gas Exchange at Lower Granite Dam during 2003 on the Proposed Total Daily Maximum Load for the Lower Snake River”.

2.7. Data Management System

2.7.1. Northwestern Division Data Management

All water control and water quality data are stored in a HEC-DSS database. Data are available in both DSS and 132 column formats. DSS utility programs are routinely used to store, list, display, and manage the data. Hourly total dissolved gas, water temperature, project flow and project spill data are posted on the Technical Management Team’s homepage (http://www.nwd-wc.usace.army.mil/TMT/).

2.7.2. Portland District Data Management

1. Portland District historic water quality data was migrated into the District’s DASLER database from the existing Microsoft Access relational database. Wendy Briner is in

the process of loading the 2003 water quality data and other historic data into the DASLER database.

2. The Portland District, along with Seattle and Walla Walla, considered database alternatives to store historic grab sample data. The three Districts selected DASLER for this data and agreed to periodically load the data to the STORET database.

3. Daily reservoir reports and total dissolved gas monitoring reports for the Columbia River are available via the District WEB site under the Water Management page. Ralph Almeria with the Northwest Division office is responsible for maintenance of the data access.

4. Water quality monitoring data collected by contractors are being stored in a Water Quality Data folder on a central server. This allows data to be available in a central location for backups and updating.

5. SEDQUAL a sediment quality database was adopted by Portland District to manage its sediment quality data. Over 4000 Portland District sediment sampling stations have been entered. Historical information is being entered for all O&M dredging projects as well as new data. Information from planning studies is also being loaded. The database at present does not include Regulatory of HTW data. ArcView software is used for geographic information system (GIS) queries.

2.7.3. Seattle District Data Management

1. Hydraulics and Hydrology Section's primary real-time data management system is a microcomputer database using HECDSS with a user-friendly Visual Basic front-end. This database system has facilitated access and communication with the District's water control and water quality data collection system and has improved accessibility for data analysis and presentation. The Northwestern Division, North Pacific Region maintains a homepage that makes much of this data available to the public via the Internet. Data collection continues to be performed by Seattle District Office.

2. The Dredged Analysis Information System (DAIS) stores chemical and biological testing data submitted for proposed dredging projects. These data are used by the Dredged Material Management Office and other participating Dredged Material Management Program (DMMP) agencies to make suitability determinations for disposal of dredged sediments at eight open-water disposal sites in Puget Sound and three open-water disposal sites each in Grays Harbor and Willapa Bay along the Washington side of the lower Columbia River. Automated reporting features are also available in DAIS, including reports summarizing sampling, testing, and administrative data. ArcView software is used for geographic information system (GIS) queries.

3. The DASLER (Data Management and Analysis System for Lakes, Estuaries, and Rivers) database was adopted by the Seattle District in June in order to manage historic and current grab sample water quality data. The Seattle District will transfer grab sample data from DASLER to the EPA's water quality database STORET.

2.7.4. Walla Walla District Data Management

1. Walla Walla District currently uses the SEDQUAL database for the storage of its dredging and sediment quality data. The Walla Walla District is currently using the guidance document developed by Portland District to populate the database templates. The data is sent to the Washington Department of Ecology's main system via E-mail.

2. The GOES satellite system remains the primary method of water quality data transmission to the existing database infrastructure.

3. The Walla Walla District, along with the Portland and Seattle Districts, considered database alternatives to store historic grab sample data. The three Districts selected DASLER for this data and agreed to periodically load the data to the STORET database.

4. Walla Walla District personnel participated in meetings with their counterparts from Seattle District, Portland District and Northwest Division to reach a consensus regarding water-quality databases. The outcome consisted of utilizing DASLER at the Districts for discrete data, followed by an upload to STORET to facilitate public access. All of the Walla Walla District discrete data that was compiled into an Access database has been transferred into DASLER. CROHMS/CWMS will continue to be the repository for real-time data.

2.8. Research and Development

2.8.1. Northwestern Division Research Projects

The Northwestern Division, North Pacific Region continues efforts with the Portland, Walla Walla and Seattle Districts, reviewing the current SYSTDG numerical modeling capabilities with a focus on how it serves the needs of the region in 2003.

2.8.2. Portland District Research Projects

1. Portland District FY2003 funded a temperature - modeling project of Hills Creek, Dexter, and Lookout Point Reservoirs.

2. Gas monitors were set up at experimental sites in the John Day forebay and Bonneville tailwater. The purpose was to determine if better total dissolved gas data could be obtained from these sites compared to existing sites.

3. Portland District continued the study of *Corbicula fluminea*, a freshwater clam, as a second test organism for bioaccumulation testing, in the Willamette pre-dredging characterization project.

2.8.3. Seattle District Research Projects

1. A TDG model was developed by ERDC to determine spill ratios for Grand Coulee Dam and Chief Joseph Dam under joint operating conditions. The goal of the model

was to determine which spill ratio produced the lowest average TDG below Chief Joseph Dam.

2. A TDG exchange study was conducted by ERDC to determine the fate and transport of TDG in the Pend Oreille River below Albeni Falls Dam.

3. The Seattle District investigated the sources of groundwater in the Kootenai River valley using stable isotopes of hydrogen and oxygen as tracers. Groundwater and river samples were collected during high flow and low flow events and analyzed for stable isotopes to determine if the river was the source of groundwater or if groundwater was originating elsewhere.

4. A temperature string was hung from a buoy in the forebay of Libby Dam to determine if the pre-existing temperature string located on the face of the dam was providing accurate temperature readings of the water for use of the selective withdrawal system.

2.8.4. Walla Walla District Research Projects

1. Six water quality pontoons used in 2002 were modified to improve stability, resulting in purchased of five new pontoons in 2003. This fleet is being equipped with temperature sensor strings and Sutron data loggers for real time data and satellite transmission capability.

2. We are testing improved TDGMS sondes for the TDG monitoring program. The new sondes will have a depth total accuracy of 0.01 ft from 1 to 10 ft and 0.02 ft from 11 to 90 ft. The absolute accuracy for the temperature sensors will be 0.05 ^{o}C over the range of –5 to 27 ^{o}C.

3. Evaluations were made comparing sediment sampling equipment in the Lower Snake River. Hand pressing of various lengths of butyl nitrate tubing then capping and withdrawing with a battery operated windless gave excellent results in sites shallower than 6 feet of water depth.

2.9. Water Quality Problems

2.9.1. Northwestern Division Problems

1. Since it's 1998 Supplemental Biological Opinion, NOAA Fisheries has called for water to be voluntarily spilled up to the full 120% TDG level at the Corps' mainstem Columbia and Snake River dams during the spill season.

2. Compliance with the State TDG standards is a recurring issue with no easy solution in sight. In some cases, water entering Corps and other federal reservoirs is already supersaturated. Any further increase in spill, either to provide a safer passage route to fish or to accommodate limited plant capacities, can only further exacerbates TDG conditions. Given the sensitivity of the spill and the related TDG issue, TDG data continued to be closely scrutinized by various agencies and interest groups. As a result,

the demands on the monitoring program increased significantly. Because of limited plant capacity spill is required at most Lower Snake River dams as soon as flows exceeded 100 kcfs. Decreasing spill through upstream storage or passing more water through the powerhouse is not always feasible. The need to operate all turbine units at flows within 1 percent of their peak efficiency flow to avoid more extensive damages to fish contributed to a *de facto* decrease in powerhouse capacities.

3. The Regional Forum Water Quality Team (WQT) continued to provide a forum for peer review and technical exchange of information on TDG. Although advisory in nature, the WQT also played an active advocacy role. The WQT reviewed and commented on the 2003 Plan of Action and TMT Spill Management Plan, as well as participating in the TDG post-season review meeting.

4. The Transboundary Gas Group met in March and October. Discussion subjects included treaty obligations and limitations, TDG monitoring and abatement measures on the Canadian side of the border and monitoring issues on the US side of the border.

5. EPA, the states and the tribes coordinated on a combined approach to TMDL issues in the Columbia and Snake River mainstems. The Corps attempted to keep abreast of these issues and provide support where feasible. The initial TMDL effort is focused on TDG and water temperature.

6. Many of the water quality programs in the North Pacific Region continued to be driven by design and/or operational actions associated with the salmon and steelhead recovery effort.

2.9.2. Portland District Problems

1. Willow Creek Lake, Oregon is eutrophic and by August, the reservoir's hypolimnion is anoxic, containing high concentrations of hydrogen sulfide, methane, ammonia and other chemically reduced substances. Phytoplankton blooms aggravate water quality problems in the impoundment. High nutrient input to the lake from the watershed continues to be a problem. Monitoring data shows inputs of phosphorus and nitrogen from Balm Creek and Willow Creek.

2. Willow Creek (below the lake) is on the State 303(d) list for temperature and pH. This year temperature improvements below the dam were again achieved by lowering the selective withdrawal device in the lake. In 2004 the lake will be aerated with the hope of improving oxygen conditions in bottom waters in order to reduce methane and hydrogen sulfide production.

3. Cougar Project. The U.S. Fish and Wildlife Service and Oregon Department of Fish and Wildlife reported in 1988 substantial reductions in the number of anadromous fish using the McKenzie River in the Willamette River Basin. The agencies attribute much of this reduction to Corps of Engineers impoundments, claiming that water released from these projects tends to be thermally sub-optimal for fish migration and reproduction. Thus, the agencies have urged the Corps to provide more favorable

release-flow temperatures at projects on the McKenzie River (Cougar and Blue River) for the purpose of improving habitat and thereby sustaining larger fish populations downstream. The greatest threat to the chinook occurs in the fall when water 10 degrees F warmer than the river temperature are released from an outlet near the surface of the reservoirs. Other reservoirs in the Willamette System (Hills Creek, Fall Creek, Lookout Point, Green Peter and Detroit) may affect downstream water temperatures in ways that impact anadromous fish as well.

4. State 303(d) Listings. In 1998 the Oregon Department of Environmental Quality (DEQ) released a new 303(d) list of "water quality limited waters". Some District reservoirs and stretches of river below reservoirs were on the 303(d) list. Interpretation of the reservoir listings is straightforward. However, listings of rivers below the reservoirs are subject to interpretation. The impact of a reservoir on downstream conditions must be evaluated on a case-by-case basis. For instance, the Coast Fork Willamette is listed for high summer temperatures from the mouth to Cottage Grove Reservoir, but the reservoir releases water in mid August that is below the 64° F Standard. In this case, the reservoir may actually be helping to make the problem less severe in a specified reach of river below. District projects with associated in-lake and downstream water quality problems described in the DEQ 303(d) list are given in Table 4 below.

Table 4. NWP Water Quality Problems on DEQ 303(d) List

Reservoir	Res. Parameter(s)	Below Res. Parameter(s)
Applegate		Flow, Temp. (summer)
Cottage Grove	Toxics – tissue, water	Temp. (summer)
Dorena	Toxics – tissue, water	Temp. (summer)
Fall Creek		Temp. (summer)
Dexter		Temp. (summer)
Fern Ridge	Turbidity, Bacteria	Temp. (summer), Bacteria
Blue River		Temp. (summer)
Cougar		Temp. (summer)
Willow Creek		Temp., PH (summer)
Bonneville		Toxics, pH, Temp.,TDG
The Dalles		Temp., TDG
John Day		Temp., TDG
Elk Creek		Temp. (summer)

Water, sediment and fish from Cottage Grove Reservoir contain elevated levels of mercury. The mine tailings from Black Butte Mine about 8 miles above the reservoir are the probable source of mercury. Some fish in the reservoir exceed the FDA action limit for mercury in muscle. Studies have been conducted to determine the loading and distribution of mercury in the water, sediment, and food chain. The State of Oregon has issued a Health Advisory concerning consuming fish from Cottage Grove Reservoir. Under the Restoration of Abandoned Mines Program (RAMS) the Corps helped fund the collection and analysis for mercury concentrations in 100 soil samples in the Black Butte mine area. The purpose of the sampling was to determine the spatial

extent of mercury contamination and the speciation of mercury from cinnabar into more readily available forms.

Fish in Dorena Reservoir contain high concentrations of mercury but for a less obvious reason than fish at Cottage Grove. Although some fish exceed the FDA action limit, concentrations are not as high as in fish from Cottage Grove Reservoir. High mercury levels may be related to the historic use of mercury in the process of refining gold in the Dorena watershed. However there is no direct evidence to support this view. The State of Oregon has issued a Health Advisory concerning consuming fish from Dorena Reservoir.

5. Dissolved Gas TDG supersaturation continues to exceed the 110% water quality standards below projects (John Day, The Dalles, and Bonneville). At the request of NOAA Fisheries (as stipulated in the NMFS 2000 BiOp), the Corps sought and obtained TDG waivers from the States of Oregon and Washington for the 2003 spill season. These waivers raised the TDG standard to 120% in the tailwaters and 115% in the forebays of the next downstream projects. In 2003, spill from John Day Dam was usually less than 170,000 ft3/s. TDG downstream from the dam increased in response to spill with TDG levels usually being less than 120% saturation. Spill from The Dalles Dam was generally between 40,000 and 120,000 ft3/s with resulting TDG levels of 110 to 120% below the dam. Spill from Bonneville Dam ranged from 75,000 to 150,000 ft3/s with TDG levels at Warrendale averaging 110 to 120% saturation. In general, spill was lower and the occurrence of TDG exceedences was fewer in 2003 than 2002 at all three projects.

6. Most of the Willamette Projects experience algae blooms of blue-greens in July and August. So far, these have not reached the nuisance stage that would lead to strong taste and odors or organic loading in water below the projects. The Hills Creek project experienced an algae bloom in August that required posting sections of the lake for a short period of time. This is a recurrent problem at Hills Creek lake.

7. According to the NOAA Fisheries Willamette River Biological Opinion on threatened Salmon and Bull Trout, Willamette Projects operations affect habitat and water quality below dams because of changes in stream hydrology. Changes in riparian habitat and aquatic ecology may be impacting fish.

8. Columbia River Projects, according to a NMFS Biological Opinion on threatened Salmon and Bull Trout, affect habitat and water quality in and below dams because of project operations. Total dissolved gas and temperature are the main culprits, but other water quality variables may also impact threatened and endangered species.

9. Bradford Island disposal site at Bonneville is a source of PCBs and other contaminants to the Columbia River. PCBs have been found in clams (Corbicula) and in crayfish residing on the site. Additional sediment samples were collected in 2003. The data report has not been prepared by the contractor.

10. Rogue River Projects. Water samples were taken by the monitoring contractor and measured for geosmin, a taste & odor compound, in response to complaints from a local water district that the river below the project has taste & odor problems in the summer.

2.9.3. Seattle District Problems

Temperature at Chief Joseph forebay and tailwater stations exceeded the Washington Department of Ecology's criteria of 18°C from July 30 through September 15, 2003. The forebay and tailwater temperatures were similar, indicating that the forebay was well mixed. Water temperatures at the forebay station exceeded the Colville Tribe Class I criteria of 16°C form June 11 through September 15, 2003.

2.9.4. Walla Walla District Problems

1. Improvements were made in the operation of wastewater plants at Little Goose and Lower Granite Dams. A new aeration system was put in at Little Goose and sludge was hauled to improve effluent quality. Modifications were begun towards installment of a composite sampler in order to get a more representative sample of effluent discharge.

2. Average system loading was within permit criteria however on two occasions the maximum daily loading exceeded the criteria for those months. Total suspended solids were also above permit criteria on several occasions. It is recommended the either that chlorine retention tank be divided or a splitter tank installed in order to retain flows under high use conditions.

3. At Ice Harbor Dam potable water inflow was separated from other water uses in preparation to develop treatment operations to reduce nitrates. High nitrates were found in potable water at Charbonneau Park.

4. Data is being evaluated to determine solutions for TDG exceedances at project locks and dams.

5. Shoreline erosion is apparent project wide. High turbidities are apparent after storm events.

2.10. Special Studies

2.10.1. Northwestern Division - Studies

The Water Quality Unit developed an approach on how long water could be released at a temperature of 45 ^{o}F was performed using mass balance calculations and two pieces of information: Dworshak Reservoir temperature profiles and gross storage table figures.

During the 2003 spill season, a gross storage table was cross-referenced with the temperature profiles to determine the volume of warm or cool water was available for temperature augmentation.

2.10.2. Portland District - Studies

1. Willow Creek Water Quality Improvement. Water temperature and pH in Willow Creek below the reservoir are elevated above Oregon Water Quality Standards during the summer months. The city of Heppner asked the Corps to operate the selective withdrawal device built as part of the reservoir project in order to improve water quality in Willow Creek. The Corps maintained its withdrawal outlet at a depth of 17 feet to release cooler water from the project.

2. RPA 132 work. The Columbia River Biological Opinion on endangered salmon contained a Reasonable and Prudent Alternative (RPA) number 132 that required studies of representativeness of forebay gas monitors at Columbia River projects. That work continued last year at John Day and The Dalles and Bonneville dams.

3. Updating of the Lower Columbia River Dredged Material Evaluation Framework (DMEF) continues. Because of Endangered Species issues and evolving concerns with dredging and dredged material placement revisions to the DMEF are considered necessary. Representatives of various federal (COE, EPA, USFWS, and NOAA Fisheries) and state agencies from Oregon, Washington and Idaho) began discussions on areas requiring updating. The updated manual, among other changes, will have a name change to the Sediment Evaluation Framework (SEF).

4. Black Butte Mine/Cottage Grove Reservoir Mercury Assessment. The initial soil assessment at and around Black Butte Mine was completed in September 2003. The Corps RAMS program and the Oregon DEQ Orphan Fund, through cooperation with the DEQ, funded this project. A total of 99 soil samples were collected by Oregon State University and the DEQ and analyzed for total mercury. Mercury speciation is being conducted. Additional assessment, pending funding, will include soil, sediment, and water sampling and analysis.

5. Oaks Bottom Wildlife Refuge, Sediment and Water Quality Evaluation (Section 206 Aquatic Ecosystem Restoration project). The sediment and water quality evaluation consisted of the collection and analysis of five sediment samples and six water samples in September 2003. The report was completed in FY04.

2.10.3. Seattle District - Studies

1. The Seattle District conducted a total dissolved gas (TDG) monitoring study at Albeni Falls Dam during May and June 2003. The purpose of the TDG study was to more clearly understand total dissolved gas exchange processes associated with the operation of Albeni Falls Dam and the resultant transport and mixing in the Pend Oreille River immediately below the project. In particular, this study sampled TDG saturations in the Pend Oreille River above and below Albeni Falls Dam during May and June of 2003 and was used to estimate the change in TDG loading associated with project operations. The study focused on resolving questions regarding accurate source and sink descriptions of mass conservation of dissolved gases in the Pend Oreille River above and below the dam. TDG time history information as related to project operations was of particular interest. The data was analyzed to provide estimates of

the relative importance of background TDG concentrations in the Pend Oreille River and of dam operations on the downstream gas exchange processes.

The TDG monitoring study deployed instruments in 3 major transects located above and below the dam in order to document the lateral and longitudinal TDG characteristics in the Pend Oreille River during the study period. The first transect included three stations in the forebay of Albeni Falls measuring the TDG pressures approaching the powerhouse and spillway. The second transect was positioned approximately 1800 feet below the spillway and consisted of 4 sampling stations measuring TDG levels in powerhouse and spillway flow prior to complete mixing and the resultant TDG loading associated with Albeni Falls operations. The third transect was located about 1.8 miles below the dam and consisted of 5 sampling stations, which provided a secondary estimate of the resultant TDG loading and a measure of the transport and mixing properties in the Pend Oreille River.

The TDG instruments were left in the river for two months monitoring the full range of Albeni Falls Dam operations. During the study period, the instruments were maintained and calibrated on a three-week cycle. The data have been downloaded and are currently under review.

2. The Seattle District Corps of Engineers, in cooperation with Lincoln County, completed a ground water quality assessment of selected wells in the Kootenai River valley in 2003. The purpose of the study was to determine whether increased discharge volumes from Libby Dam, and the resulting high flows in the Kootenai River affected ground water resources in the Kootenai River valley through direct contamination of drinking water wells, or by saturating on-site wastewater treatment and disposal systems on properties adjacent to the Kootenai River. The major objectives of this study were:

   - ✓ To evaluate the water quality of drinking water wells during high flow and base flow, to determine whether significant differences exist
   - ✓ To determine whether drinking water wells were contaminated by on-site wastewater disposal systems during high flow conditions
   - ✓ To evaluate how high flows in the Kootenai River affect surface water and ground water exchange along the Kootenai River valley
   - ✓ To identify the source(s) of ground water in the Kootenai River valley
   - ✓ To determine whether drinking water wells are under the direct influence of surface waters.

   These objectives were addressed using data collection and analysis methods to evaluate ground water quality, surface water quality, and ground water-surface water exchange characteristics. Data were collected from eight (8) drinking water wells, seven (7) river stations, six (6) monitoring wells, and four (4) river stage gages. The study was conducted from June through December 2002 and focused on the Kootenai River valley from Libby Dam to Troy, Montana.

3. Water quality samples were collected at Howard Hanson Reservoir from April through October 2003. The goal of the monitoring program was to characterize the water quality of Howard Hanson Reservoir during a normal storage year to establish baseline conditions from which determination of potential water quality impacts from elevated reservoir storage conditions can be assessed. Specifically, there was concern about the potential for increased reservoir elevations to lead to increased concentrations of nutrients, organic matter, and phytoplankton in the reservoir. To meet the project goals, water quality was monitored in the Green River and Howard Hanson Reservoir during normal pool elevations. Water quality parameters of concern included temperature, dissolved oxygen, nutrients (i.e. phosphorus and nitrogen), organic matter, chlorophyll a, and phytoplankton. Additional water quality parameters such as pH, conductivity, and alkalinity were monitored to help with the basic understanding of the limnology of the reservoir. Sampling consisted of collecting monthly samples from the epilimnion and hypolimnion, and conducting vertical profiles for temperature, pH, conductivity, and dissolved oxygen every three weeks.

4. Water quality monitoring was conducted at Libby Dam and Lake Koocanusa during 2003. Water quality grab samples were collected at monthly intervals in Lake Koocanusa at three stations between the international border and the forebay from April through October. Samples collected from the epilimnion and hypolimnion were analyzed for conventionals, nutrients, and metals. A composite sample from the photic zone was analyzed for chlorophyll a and algae. Vertical profiles of temperature, conductivity, pH, and dissolved oxygen were also recorded at each station. A downstream station on the Kootenai River was monitored at monthly intervals from January through December, with samples being analyzed for conventionals, nutrients, and metals.

5. Chief Joseph Dam/Lake Rufus Woods temperature study. A temperature study of Lake Rufus Woods continued in 2003. The purpose of the study was to determine changes in water column temperature in Lake Rufus Woods between Grand Coulee Dam and Chief Joseph Dam. Three temperature strings were deployed in the reservoir between Grand Coulee and Chief Joseph. Temperature strings consisted of Vemco data loggers attached at various depths to a weighted cable and secured in place with an anchor and buoy. Temperature was recorded every hour from June through October 2003. This study will continue in 2004.

6. Libby Dam/Lake Koocanusa temperature study. A temperature study of Lake Koocanusa continued in 2003. The purpose of the study was to examine the thermal properties in the forebay to aid in determining Libby Dam release temperatures that would benefit downstream sturgeon populations. A single temperature string was deployed in the forebay consisting of Vemco data loggers attached at various depths between the surface and bottom of the reservoir. Temperature was recorded every hour from April through November 2003.

7. The Seattle District is conducting a baseline water quality assessment of fish hatchery water sources at Chief Joseph Dam during the 2004 water year. Potential sources of

water identified for this study include the relief tunnel, the irrigation inlet structure located near the right bank in the forebay, and the orientation water system wells located along the right bank at the hatchery site. The fish hatchery would utilize one or more of these sources of water during the entire year to meet the quantity and quality of water needed for hatchery operations.

The quality of the proposed hatchery source water is important because water quality can determine the success or failure of fish hatchery operations. Historical sampling conducted in 1989 and 1990 at the relief tunnel and hatchery site wells detected mercury and nitrite in concentrations exceeding Washington State Department of Fish and Wildlife recommended water quality criteria for aquaculture programs. Consequently, the Colville Tribe expressed concerns about the quality of the relief tunnel and orientation water system wells water for hatchery operations. To address these concerns, the Seattle District designed a water study to quantify more precisely the water quality of all potential water sources for the fish hatchery.

The study is currently being conducted during 2004 and has not been completed. However, samples collected in May 2003 and February 2004 had no exceedances of the Washington Department of Fish and Wildlife's recommended criteria for fish hatcheries.

8. Lower Columbia River Dredged Material Evaluation Framework. This interagency team includes representatives from Seattle District, Portland District, Northwestern Division, Washington Departments of Ecology and Natural Resources, EPA Region 10 and the Oregon Department of Environmental Quality. The team has developed a regional manual for the evaluation of dredged material intended for disposal in the aquatic environment. A full public interest review was completed, and the agency heads signed the final document in November 1998.

9. Regional Sediment Evaluation Team (RSET). NWS is participating on the RSET to develop a regional dredged material management manual for use in Oregon, Idaho, and Washington.

2.10.4. Walla Walla District - Studies

1. Sediment sampling for Proposed 2003/2004 dredging was completed. A report was generated. Data was validated at QA/QC level II.

2. Woody Riparian sediment sampling was completed in six Lower Snake River Reservoir areas. Extensive chemical sediment data was generated for historical reference. Implications will be important for framework evaluations.

3. Information was generated that can be useful for implementing habitat improvements along with dredge disposal beneficial uses.

2.11. Contract Work

The Northwestern Division, awarded no contracts in 2003. A detailed listing of the contract costs listed in Table 5.

Table 5. Water Quality Contracts Awarded in 2003

Northwestern Division	Amount ($)
Region's Total	0
Portland District	
WATER QUALITY	
ROGUE PROJECTS	
1. John Salinas, The Cascade Research Group, Murphy OR; CWA water quality monitoring of Lost Creek and Applegate Lakes, Rogue River Basin, OR	37,345
WILLOW CREEK PROJECT	
2. Aeration equipment purchase for Willow Creek Lake	50,333
3. Lilly Consulting, limnological monitoring of Willow Creek lake .	13,500
WILLAMETTE VALLEY PROJECTS	
4. USFS water quality monitoring at Cougar Lake during construction of Selective Withdrawal Structure (SWS)	17,163
5. Cougar Supplementary Information Report (SIR) studies of sediment transport and DDT export during construction of the SWS at Cougar Reservoir.	159,750
6. USGS, install and maintain water quality equipment in gages above & below Cougar Reservoir during construction of SWS.	46,180
7. Operation of 3 Bureau of Reclamation Agrimet weather stations to provide data for temperature modeling work at three projects – Hills Creek, Lookout Point and Detroit Reservoirs. The models will support COE Willamette Valley TMDL efforts.	10,500
8. Develop CE-QUAL-W2 temperature models of Hills Creek and Lookout Point Reservoirs in support of Willamette Valley temperature TMDL.	185,000
9. Cooperative Agreement with OSU to perform mercury studies at Black Butte Mine under the Restoration of Abandoned Mines Program (RAMS).	10,000
10. Jim Sweet, Aquatic Analysts, phytoplankton identification workshop.	786
COLUMBIA RIVER PROJECTS	

11. USGS: CWA, TMDL and ESA TDG monitoring in lower Columbia River.	180,241
12. STENNIS. FMS equipment rental DCP for TDG monitoring in lower Columbia River.	18,826
13. Columbia River BiOP RPA132 – representiveness of forebay gas monitor studies by ERDC - TDG monitoring in lower Columbia River.	53,000
14. FMP Real Estate Lease – The Fishery - Warrendale, OR - TDG monitoring in lower Columbia River.	1,200
USGS GAGING STATION CONTRACTS DETAILS	
14252580 Toutle River, Twr Road, Nr Silver Lake, Wa	27,300
14330000 Rogue River Blw Prospect, Or	2,980
14337500 Big Butte Creek Nr Mcleod, Or	11,970
14337600 Rogue River Nr Mcleod, Or	2,980
14339000 Rogue River At Dodg Br Nr Egl Pt, Or	11,860
14359000 Rogue River At Raygold, Or	2,980
14362000 Applegate River Nr Copper, Or	2,980
14366000 Applegate River Nr Applegate, Or	2,980
14369500 Applegate River Nr Wilderville, Or	2,980
14372300 Rogue River at Agness	1,860
SEDIMENT QUALITY	
SEDIMENT QUALITY & ODMDS EVALUATIONS	
1. Severn Trent Laboratories – Bachelor Slough, Sediment analyses.	15,190
2. Severn Trent Laboratories –Skipanon Channel and Boat Basin, Sediment analyses.	13,705
3. Severn Trent Laboratories – Crims Island, Sediment analyses.	4,230
4. Severn Trent Laboratories – Astoria TB , Sediment analyses.	22,904
5. Severn Trent Laboratories – Depot Slough, Sediment analyses.	6,825
6. Severn Trent Laboratories – Old Mouth of the Cowlitz River, Sediment Analyses.	4,900
7. Severn Trent Laboratories – Kalama TB, Sediment analyses.	4,000
8. Severn Trent Laboratories – Oaks Bottom, Sediment analyses.	11,900
9. Severn Trent Laboratories – Cougar Reservoir, Sediment & Water analyses.	5,000
10. Hart Crowser, Inc. Willamette River Reference Site Project – Total $119,630	52,637
11. Hart Crowser, Inc. Willamette River Federal Navigational Project Maintenance Characterization.Total $288,339	100,000
12. Hart Crowser, Inc. Dredge Material Evaluation Framework Update.	90,000
13. John Vlastelicia – Boat & Operator, Skipanon sediment sampling.	1,905
14. John Vlastelicia – Boat & Operator, Bachelor Slough sediment sampling.	1,785
15. Sidescan Sonar/Sediment Acoustic Characterization	31,432
16. Hydrosurvey Boat and Crew	29,125

17. Sidescan Sonar Yaquina Bay	35,231
18. Benthic Infauna Evaluation Yaquina Bay	49,600
Seattle District	
1. U.S. Geological Survey (Montana District): Field water quality data collection/analysis on Lake Koocanusa (3 reservoir stations, 1 Riverine station)	72,000
2. Columbia Basin Environmental: Dissolved gas sensor operation and maintenance for Chief Jo0seph forebay and tailwater and Libby tailwater	25,000
3. Aquatic Research Inc.: Howard Hanson Reservoir Water Quality Analysis	6,500
4. Seattle Public Utilities: Howard Hanson Reservoir analyses	1,500
5. Spokane Tribal Laboratories: Howard Hanson Reservoir zooplankton analysis	1,500
6. Engineering Research and Development Center (ERDC): Albeni Falls Dam Total Dissolved Gas Exchange Study	50,000
7. Anchor Environmental: 2003 Sediment Management Annual Review Meeting minutes	595.29
8. Anchor Environmental: Duwamish Operations and Maintenance Dredging Sediment Quality Evaluation	$26,621
9. Anchor Environmental: Everett Downstream Operations and Maintenance Dredging Sediment Quality Evaluation	$39,906
10. Anchor Environmental: DAIS data entry of dredged material characterization data	$18,591
11. Anchor Environmental: Physical Monitoring Data Quality Review and Interpretation of the 2003 Commencement Bay non-dispersive disposal site Sediment Profile Imagery Survey Data.	$4,323.48
Walla Walla District	
1. TDG forebay fixed monitoring station review and evaluation study; OA Systems.	99,000
2. Temperature QA/QC protocol, water temperature collection for modeling; OA Systems.	38,000
3. Dworshak temperature study and water quality sampling; OA Systems.	48,557
4. Sediment sampling for proposed 2003/2004 dredging; Sampling by OA Systems, and chemical analysis by Anatek, SVL, Geolab and Columbia Laboratories. Chemical data quality review for the proposed 2003/2004 Confluence dredging study analysis. Kismet Scientific services.	167,000

5. Swim beach, drinking and wastewater analyses were also performed by Anatek Labs throughout the year	5,000
6. HDR Engineering was awarded a contract assist the district in pipe repair of the TDG FMS stations.	221,000
7. HDR Engineering was awarded a contract assist the district in maintenance, deployment and calibration of the TDG FMS stations.	196,000
8. Sutron data logger satellite telemetry system for TDG	28,000
9. USGS: Sutron data logger satellite telemetry system for TDG	28,000
10. Chemical analysis by Anatek Lab and SVL on Martindale Island cultural site environmental reconstruction sediment analysis.	16,500
11. Chemical analysis by Anatek and SVL Laboratories on sediment sampling for woody reparian program.	38,000
12. A hazardous waste contract was written and is currently in contracting contingent on funding availability. It covers disposal of oil, grease, hazardous waste, lighting waste and special waste.	600,000

2.12. Meetings and Conferences

2.12.1. Northwestern Division

1. Water Quality Team staff (Jim Adams, Laura Hamilton and Nancy Yun) attended numerous in-house meetings of the regional Technical Management Team discussing weekly flow augmentation operations for fish during April-August 2003.

2. Jim Adams attended The Mainstem Water Quality Plan Workgroup that pursue regional water quality planning and policies including TMDL and total dissolved gas waivers.

3. Jim Adams attended NOAA Fisheries technical Water Quality Team meetings concerning Total Dissolved Gas and water temperature.

4. Laura Hamilton attended the US-Canada Transboundary Gas Group meeting at Lake Roosevelt, Wa. on April 23, 2003. She made a presentation on the Corps FMS monitoring program and spill program**.**

5. Jim Adams attended DASLER database training in Portland in June 2003.

6. Jim Adams attended the TMDL Implementation in Watershed Restoration" conference sponsored by Eastern Washington State University in Stevenson Washington.

7. Jim Adams, Laura Hamilton, Nancy Yun and Tina Lundell attend SYSTDG training once a month from June through December 2003 in preparation of using the model during the 2004 spill season.

8. Laura Hamilton attends numerous in-house meetings on the CWMS transition and CWMS pathnames.

2.12.2. Portland District Meetings

1. Jim Britton attended monthly Water Quality Team (WQT) meetings at the NOAA Fisheries office.

2. Jim Britton attended the Oregon DEQ's Model Coordination Team (MCT) meetings that advise the State in its temperature TMDL modeling effort.

3. Jim Britton attended the Cougar Reservoir Environmental Coordination Committee meetings.

4. Jim Britton attended the Columbia River BiOP RPA143 Snake River temperature modeling meetings.

5. Tim Sherman, Wendy Briner, Donna Ebner, Mark Siipola, and Jim Britton completed Motorboat Operators Training.

6. Donna Ebner and Wendy Briner attended SEDQUAL database training in Portland in January 2003.

7. Jim Britton, Donna Ebner, and Wendy Briner attended DASLER database training in Portland in June 2003.

8. Donna Ebner, Wendy Briner, Tim Sherman, and Mark Siipola attended the Sediments 2003 conference in Portland in September 2003.

9. Jim Britton, Donna Ebner, Wendy Briner, Tim Sherman, and Mark Siipola attended the Contaminated Sediments Assessment and Management Workshop in Portland in June 2003.

10. Jim Britton attended a watershed modeling conference sponsored by ERDC in July in Sacramento, CA.

2.12.3. Seattle District Meetings

1. Kent Easthouse and Marian Valentine participated in various Program Management Plan meetings in Portland.

2. Kent Easthouse and Marian Valentine participated in various database meetings in Portland.

3. Kent Easthouse and Amy Klein attended the Transboundary Gas Group meeting in Nelson, B.C. (October 2003).

4. Kent Easthouse attended the Washington State Department of Ecology's interagency review on the proposed Mid-Columbia River and Lake Roosevelt TMDL and implementation plan for controlling total dissolved gas in Wenatchee, WA (December 2003).

5. David Kendall participated in the 2003 Sediment Management Annual Review Meeting and one presentation, which included a summary of 2003 DMMP actions and accomplishments. He also prepared a DMMP policy clarification paper entitled: "Regency Guideline Exceedances: Guidelines for Retesting in High Ranked Area."

6. Lauran Warner participated in the 2003 Sediment Management Annual Review Meeting and made presentations on program technical and policy clarifications for the Dredged Material Management Program.

7. Lauran Warner (OD-TS-DM) attended the Pacific Northwest Chapter meeting of the Society of Environmental Toxicology and Chemistry, in Port Townsend, WA, April 2003.

8. Stephanie Stirling participated in the 2003 Sediment Management Annual Review

9. Stephanie Stirling attended the March 2003 and September 2003 meetings of the Regional Sediment Evaluation Team, and gave presentations on the Regulatory program and on policy committee actions and changes

10. Stephanie Stirling attended the 2003 Western Dredging Association meeting in Honolulu, HI.

2.12.4. Walla Walla District Meetings

1. Russ Heaton attended the RSET (regional sediment evaluation team) meeting. Steve Juul attended regional meetings for RPA 132, and 143 as a member of the water quality team.

2. Steve Juul attended a "TMDL Implementation in Watershed Restoration" conference in Stevenson Washington in October.

3. Steve Juul and Russ Heaton attended the "Contaminated Sediments Assessment and Management Workshop" in Portland, Oregon.

2.13. Future Water Quality Objectives/Reports

2.13.1. Northwestern Division Objectives 2004

1. Continue to coordinate and monitor the Corps annual total dissolved gas monitoring program.

2. Continue to monitor and adjust spill levels at Corps projects during the spill season to maintain TDG levels below the state standards of 115% in the forebays and 120% in the tailraces.

3. Continue to develop, maintain and operate an active homepage for real-time use in water management of the Columbia River reservoir system.

4. Continue to improve Division-District coordination on water quality database and data support to others as needed..

5. Continue to improve Division-District coordination on water quality and related issues.

6. Continue to provide the required level of oversight to the Dissolved Gas Abatement Study team; and to represent the Division at regional forums dealing with compliance issues involving total dissolved gas and other water quality parameters.

7. Work with The Mainstem Water Quality Plan Workgroup to resolve state water quality variance issues.

8. Work with the development of an inter-agency Water Quality Plan for the Columbia/Snake system.

9. Participate in TMDL development for TDG and water temperature on the Columbia/Snake mainstems.

10. Participate in the development of a CENWD – North Pacific Water Quality Team to provide regional program management guidance.

11. Develop and implement 1-year and 5-year Water Quality Plans as specified in the 2000 NMFS BiOp.

12. Participate with BPA and BOR in water temperature and TDG modeling as specified in the 2000 NMFS BiOp.

2.13.2. Portland District Objectives 2004

<u>WATER QUALITY</u>

1. Continue to operate and maintain stream-gaging programs in the Willamette and Rogue River Basins, Oregon, Willow Creek basin, and in Toutle River basin, Washington, and in the Lower Columbia River main stem.

2. Work with Oregon resource agencies to develop instream-flow rules for the Willamette River requiring the Corps of Engineers to provide specific flows year-round for fisheries and water quality enhancement.

3. Continue coordination with resource agencies to assure Portland District's compliance with Federal and State water quality regulations at existing and proposed Federal projects.

4. Develop study plan for RAMS program and seek funding for Black Butte mine in the watershed of Cottage Grove Reservoir. Continue studies of mercury contamination in Cottage Grove and Dorena Reservoirs.

5. Continue selective withdrawal at Willow Creek Reservoir to aid locals in reducing temperatures in Willow Creek below the project.

6. Complete installation of aeration equipment at Willow Creek Reservoir to improve water quality by reducing H_2S and methane production.

7. Review historic and current data to determine problem specific water quality studies to conduct at Corps projects.

8. Continue to implement the District Fixed Monitoring Program (FMP) for monitoring TDG below Corps Projects in the lower Columbia River. Evaluate the need for dropping and/or moving FMP sites to improve the programs goal of monitoring compliance with water quality standards.

9. Continue to monitor TDG below Corps Projects in the Willamette and Rogue Basin on an as-needed basis.

10. Continue to participate with the U.S.F.S. and the city of Salem as a team member to monitor water quality in the North Santiam Watershed.

11. Implement plans and specifications for water quality monitoring during construction of the Selective Withdrawal Tower at Cougar Reservoir and Blue River Reservoir.

12. Continue to support efforts to set up water quality models of District Projects that have water quality problems.

13. Support the State and EPA in developing TMDLs for the Willamette and Columbia River.

14. Continue participation in developing a Water Quality Plan for District projects in the Lower Columbia River as required in the NMFS Biological Opinion on saving threatened fish species.

SEDIMENT QUALITY

1. Continue the District-wide sediment quality evaluation program at Operations and Maintenance dredging projects during FY 2004, sediment quality evaluations are scheduled in the Columbia and Lower Willamette Rivers, Coos Bay and Yaquina River.

2. Continue coordination with resource agencies to assure Portland District's compliance with Federal and State water quality regulations at existing and proposed Federal navigation projects.

3. Additionally, advise the Regulatory and Environmental Resource Branch (CENWP-EC-R) on testing procedures and interpretation of results for Section 404/103 permit actions.

4. Continue to develop and update management/monitoring plans and implement the management/monitoring programs for ODMDSs.

5. Continue to participate in development of regional dredging teams as defined in the December 1994 MARAD report including the updating of the regional Sediment Evaluation Framework under the Regional Sediment Evaluation Team.

6. Complete Section 102 selection documentation for new disposal sites at MCR and Site F at Coos Bay.

2.13.3. Seattle District Objectives 2004

1. Continue maintenance and updates to the Dredged Analysis Information System (DAIS).

2. Continue to operate and maintain stream-gauging programs throughout the District.

3. Continue to monitor water quality in Lake Koocanusa and the Kootenai River.

4. Continue automating data collection capabilities in the Lake Washington Ship Canal.

5. Continue development and application of a predictive model of salinity intrusion for the Lake Washington Ship Canal.

6. Continue interagency discussion to develop solutions to dissolved gas problems above and below Chief Joseph Dam.

7. Continue to evaluate the water quality impacts of installing at least one new generating unit at Libby Dam to allow high flows with reduced risk of spill and high TDG levels.

8. Continue to monitor and assess the possible water quality impacts of additional water storage at Howard Hanson Dam.

9. Continue to monitor water column temperatures in Lake Rufus Woods (Chief Joseph Dam) and Lake Koocanusa (Libby Dam).

10. Implement a total dissolved gas data collection program for Albeni Falls Dam and the Pend Oreille River.

11. Collect total dissolved gas data collection program for Albeni Falls Dam and the Pend Oreille River.

12. Develop and implement water and sediment quality monitoring programs at Chief Joseph Dam (Lake Rufus Woods).

13. Develop and implement water and sediment quality monitoring programs at Albeni Falls Dam (Pend Oreille River).

14. Develop and implement a temperature study at Albeni Falls Dam, Lake Pend Oreille, and the Pend Oreille River.

2.13.4. Walla Walla District Objectives 2004

1. Complete and put in operation 11 temperature buoys with real time data capability and satellite transmission. Support RPA 143 for additional temperature thermister string sampling points using protocols developed in 2003. Mid pool locations will also be evaluated.

2. Continue to support forebay temperature fixed monitoring site evaluations. Thermisters will be placed on selected forebay wing wall sites for comparisons.

3. Conduct limnological investigations in the Lower Snake and Columbia Rivers. Review past Dworshak monitoring and provide appropriate data for operational assessments.

4. Participate in the WDOE dissolved gas and temperature TMDL development process.

5. Facilitate transition of limnological data to a regional database by loading water quality information into STORET. Load sediment information from continuing studies into SEDQUAL.

6. Write and procure multiyear contracts for laboratory analysis of water and sediment samples. Write a contract for boat maintenance.

7. Sample sediment at two additional sites in the reservoir above Lower Monumental Dam. Support Doppler profiling to generate velocity, temperature and bathymetry data for transects in the area.

8. Provide informational and operational assistance for water and wastewater management at Little Goose and Lower Granite dams. Provide technical water quality assistance to field offices.

9. Evaluate Sweeney brand sondes, high precision barometers, DigiQuartz portable lab barometer and Greenspan water quality multiprobes.

3. Project-Specific Information for 2004

3.1. Portland District Projects 2004

3.1.1. Rogue River /Lost Creek Lake-Applegate Lake Water Quality

a. Summary. John Salinas, The Cascade Research Group, collected temperature data at selected sites below Lost Creek and Applegate Reservoirs to obtain data on how far downstream each project impacts water temperature. Contractor will prepare report of findings.

b. Proposed Activities. No new activities are currently planned.

3.1.2. Rogue River Projects/Elk Creek Turbidity

a. Summary. A limited turbidity monitoring program was continued at the Elk Creek dam site. The objective was to assess the impact of dam construction on Rogue River water quality, and to obtain data for use in the verification of a numerical model. Turbidity data are collected hourly at four stream gauging stations, which are operated and maintained by the USGS under contract with the Portland District.

The history and monitoring capabilities of each of these stations are as follows:

- ID/STREAM/LOCATION/PARAMETERS/INITIATION YEAR
- 14338000/Elk-Creek-NR-Trail/TEMP-TURB-TEMP/June 1973
- 14337800/Elk-Creek-NR-Cascade-George/TEMP-TURB-TEMP/Aug1973
- 14337830/Elk-Creek-Below-Alco-Creek/TEMP-TURB/May 1986
- 14338100/Rogue-Riv-Below-Trail/TEMP-TURB/May 1988

Also selected as a turbidity monitoring site was a stream-gaging station located on West Branch Elk Creek (USGS Gage Number 14337870). Stream discharge and temperature data have been collected at this site since October 1973 and August 1977, respectively.

b. Proposed Activities.
Work will continue in 2004 but at only two stations.

3.1.3. Willow Creek Lake Project

a. Summary. Aquatic Analysts, Portland, and Dr. Marvin Lilley, University of Washington, continued with water quality and limnological studies at Willow Creek Lake Project in 2003. Methane and hydrogen sulfide production as well as temperature profiles of the lake were conducted once per month in August, September and October.

b. Proposed Activities.
Aeration equipment will be installed at Willow Creek Reservoir in 2004 to improve water quality by reducing H_2S and methane production. Limnological and water quality studies, including research on methane production, will continue.

3.1.4. Willamette Valley Projects

a. Summary. Most monitoring this year occurred at Cottage Grove, Dorena, Hills Creek, Lookout Point, Cougar, Green Peter and Detroit Reservoirs. Water temperature models were developed for Hills Creek, Lookout Point and Dexter Reservoirs to help the Corps and DEQ implement a temperature TMDL and to support future ESA-related work. Hydrolab data was collected at Cougar and Blue River reservoirs by the USFS. This data was collected to provide historical data to help in assessing the impacts of construction of the remodeled Selective Withdrawal Tower on water quality.

b. Proposed Activities.
Spill related TDG concentrations in waters below projects, where fish concerns are paramount, will continue to be measured on a spot basis. Specific water quality problems will be investigated as the need arises. Water quality models will be set up for Green Peter and Foster reservoirs to aid in the operation of the projects and help the Corps complying with TMDL and ESA requirements.

3.1.5. Detroit Dam and Reservoir

a. Summary. A BOR weather station was set up at the USFS office site next to the lake. The data will be used to develop a temperature model of the reservoir.

b. Proposed Activities.
In 2004 the BOR weather station will be maintained.

3.1.6. Columbia River Projects - TDG Fixed Monitor Program (FMP)

a. Summary. Monitoring of TDG concentrations continued in the forebay and tailwater of John Day, The Dalles and Bonneville dams and at Camas below Bonneville to provide real-time data for operations, and time series data for research and modeling efforts through the Fixed Monitoring Program. Columbia River BiOP RPA132 studies were initiated at new John Day forebay and Bonneville tailwater sites to assess whether these are better ESA and TMDL sites. Alternate forebay monitors were set up at John Day and The Dalles project to check the current forebay sites for representativeness.

b. Proposed Activities.
Continue TDG monitoring at the FMP sites under MIPR to the USGS. Continue forebay representativeness studies at John Day and The Dalles and Bonneville.

3.1.7. Dredged-Material Evaluations for Navigation Projects

a. Summary. Dredged-material evaluations were conducted for sediments at Astoria Turning Basin, Bachelor Slough, Depot Slough, Crims Island, Oaks Bottom, Old

Mouth of the Cowlitz River, Kalama Turning Basin, Bonneville 2nd Trash Rake, and Skipanon Channel and Boat Basin.

b. Proposed Activities. No new activities are currently planned.

3.2. Seattle District Projects 2004

3.2.1. Lake Koocanusa (Libby Dam)

a. Summary. The U.S. Geological Survey performed water quality monitoring below Libby Dam and at three sites within the reservoir. The monitoring program consists of analyses for nutrients, inorganic compounds, heavy metals, chlorophyll, pH, specific conductivity, dissolved oxygen, and temperature. These analyses help identify pollution from upstream agricultural, mining, industrial, and municipal sources. They also establish a baseline for identifying similar types of pollution from sources downstream of the project.

A ground water monitoring study was completed in the Kootenai River valley during 2003. The goal of the monitoring program was to characterize the shallow and deep ground water quality of properties adjacent to the Kootenai River downstream of Libby Dam before, during, and after the voluntary and involuntary spill that occurred from June 24 to July 7, 2002 to determine if water quality impacts occurred during high flow conditions. Specifically, there was a concern about the potential for increased flows to lead to contamination of drinking water wells or saturation of on-site wastewater treatment and disposal systems.

A temperature study of Lake Koocanusa continued in 2003. The purpose of the study was to study the thermal properties in the forebay to aid in determining Libby Dam release temperatures that would benefit downstream fisheries.

b. Proposed Activities. The Seattle District will continue to monitor water temperature in both Lake Koocanusa, and downstream in an effort to meet water temperature criteria set forth by the US Fish and Wildlife Service in their annual guidelines for white sturgeon recovery. The District will continue to monitor water quality in Lake Koocanusa at three stations and in the Kootenai River at one downstream station.

3.2.2. Pend Oreille Lake (Albeni Falls Dam)

a. Summary. A total dissolved gas exchange study was conducted in 2003. The purpose of the study was to define and quantify processes that contribute to dissolved gas transfer during normal operations (including involuntary spill) at Albeni Falls Dam. The study focused on resolving questions regarding accurate source and sink descriptions of mass conservation of dissolved gases in the Pend Oreille River below the dam.

b. Proposed Activities. Install TDG monitoring stations in the forebay and tailwater as well as implement a temperature study in Lake Pend Oreille and the Pend Oreille River.

These two activities are of paramount importance because of proposed future temperature and TDG TMDLs on the Pend Oreille River.

3.2.3. Rufus Woods Lake (Chief Joseph Dam)

a. Summary. Dissolved gas and water temperature data were collected in the forebay and in the tailwater. A temperature study of Lake Rufus Woods continued in 2003. The purpose of the study was to determine changes in water column temperature in Lake Rufus Woods between Grand Coulee Dam and Chief Joseph Dam. Three temperature strings were deployed in the reservoir at three locations between Grand Coulee and Chief Joseph. Vertical profiles of temperature, conductivity, pH, and dissolved oxygen were collected in August and October at each temperature string location.

b. Proposed Activities. The District will implement a water quality monitoring program in 2004. The monitoring program will consists of analyses for nutrients, inorganic compounds, heavy metals, chlorophyll, pH, specific conductivity, dissolved oxygen, and temperature. Water quality monitoring is needed to establish adequate baseline information on the physical, chemical, and biological condition of Lake Rufus Woods and the tailrace. This data will allow the Seattle District to define the relationship between Chief Joseph Dam and the water quality in the Columbia River downstream of Grand Coulee Dam.

3.2.4. Lake Washington Ship Canal and Locks

a. Summary. Saltwater intrusion into Lake Washington through the ship canal was prevented in WY 2003. The District collected salinity and temperature data from five stations that automatically transmit hourly data to the Reservoir Control Center through the District's water control data collection system. Periodic field measurements were made at sampling stations in the canal and Lake Union to ground-truth the automated sensor data.

b. Proposed Activities. The District plans to update water quality monitoring equipment in 2004, and will continue to monitor salinity levels and temperatures in the Lake Washington Ship Canal and Lake Union. This data will be used to determine lock operations associated with control of saltwater intrusion. The District will continue to look at operational effects on water quality upstream of the locks and in the ship canal.

3.2.5. Wynoochee Dam and Lake

a. Summary. During the summer stratification period, the intake temperature panel system was used to regulate downstream temperatures during operation of the hydroelectric plant. The downstream temperature control point for the Wynoochee Project is the USGS River Gauging Station known as the Wynoochee River at Grisdale Gauge. A sensor at that gauging station reports river temperature on a real-time basis. In addition to the Grisdale Gauge, there is a sensor monitoring the temperature of the water in the hydroelectric plant tailrace.

b. Proposed Activities. No new activities are currently planned.

3.2.6. Howard A. Hanson Dam and Reservoir

a. Summary. A limnological study of Howard Hanson Reservoir continued in 2003. Nutrients, alkalinity, chlorophyll *a*, phytoplankton, and organic matter were monitored monthly in the epilimnion and hypolimnion at two in-reservoir stations from May through October. In addition, water column profiles of temperature, pH, dissolved oxygen, and conductivity were monitored bi-weekly at six in-reservoir locations.

b. Proposed Activities.
Seattle District will continue to monitor upstream, in-reservoir, and downstream water quality at Howard Hanson Dam.

3.2.7. Mud Mountain Dam

a. Summary. Water quality data collection efforts in WY 2003 were limited to daily measurements of temperature and turbidity above and below the reservoir as a guide in regulating release patterns and to comply with State and Federal regulations. Most water quality problems at Mud Mountain Project are related to a high suspended-solids load associated with upstream glacial melt and erosion of sediment accumulations upstream of the project and in the reservoir. During and immediately following high flows and in association with some project maintenance procedures, relatively short-term high turbidity levels will be experienced that will exceed State of Washington water quality standards.

The White River has a naturally high sediment load during storm events. During significant storms, a large amount of debris from the upstream watershed may enter the reservoir. While much of the debris is usually collected in upstream areas, some of it may accumulate on the trash-rack. As debris is removed from the trash-rack, the river lowers and can cut channels through accumulated sediment upstream of the dam resulting in higher turbidity during these operations.

b. Proposed Activities. No new activities are currently planned.

3.3. Walla Walla District Projects 2004

3.3.1. Columbia River Projects - TDG Fixed Monitor Program.

a. Summary. The TDGMS system operated all sixteen sites in the Walla Walla District. Nine of the sites were operated year round and seven were seasonal. Sensor performance evaluations were completed using the primary standards calculated to quantify the absolute accuracy capability and repeatability of the TDGMS instruments. A comprehensive QA/QC program for TDGMS was utilized.

Seasonal and year-round TDG monitoring was performed at several locations. Specific sites included:

i. Dworshak (DWQI) on the North Fork of the Clearwater River.

ii. Peck (PEKI) and Lewiston water intake (LEWI) on the main stem Clearwater River.
iii. Anatone (ANQW), Lower Granite (LWG), Lower Granite tailwater (LGNW), Little Goose (LGS), Little Goose tailwater (LGSW), Lower Monumental (LMN), Lower Monumental tailwater (LMNW), Ice Harbor (IHR), Ice Harbor tailwater (IDSW) on the Snake River.
iv. Pasco (PAQW), McNary forebay Oregon (MCQO), McNary forebay Washington (MCQW) and McNary tailwater (MCPW) on the Columbia River.

New high density polyethylene submerged pipe sonde deployment systems were installed at four additional tailwater TDG Fixed Monitoring System (FMS) stations. This completed the changeover to the new systems for all project tailwater FMS that was begun in 2002. Repairs were needed at several stations and additions were made to improve the cabling and anchoring. It was determined that some breakage had occurred from friction at the cable pipe interface.

Heavy duty chain was used to replace the cable wraps on the pipe and larger diameter cabling was used in addition to increased anchoring sites. The modifications were made at Pasco, Lewiston, Lower Monumental, Little Goose, Lower Granite and Dworshak tailwater stations.

A comprehensive study of TDG in the dam forebays was completed. Forebay water temperature warming and down welling appear to be influencing sampling. Present locations may also not be representative due to circulation problems and depth placement. Recommendations included relocating stations upstream of the main project and to a depth of 12-15 meters.

Recently purchased improved precision barometric pressure sensors were evaluated. These barometers are equipped to provide multiple SD-12 output and are capable of providing pressure transducers with real time differential corrections. New sondes had to be remachined to cure a false signal affecting the software.

b. Proposed activities in 2004
Plans are to start replacing existing sondes during the 2004 summer season.

3.3.2. McNary Project and Reservoir

a. Summary.
Reservoir temperature data proximal to the forebays was collected using Onset StowAway® sensors during the Review and Evaluation of TDG fixed monitoring stations study. This data is available for evaluation and to support modeling that may be expanded to areas downstream of the Lower Snake River. It is interesting to note that the preliminary data in the study showed that temperature was not significantly different between the Washington and Oregon forebay stations. Two alternative stations also gave comparable data for the study period.

Corps fish biologists placed battery operated temperature sensors that recorded readings hourly at fish passage facilities from 1 April to 31 October at the North ladder exit, entrance and first diffuser as well as the South Ladder exit, first diffuser, and the south junction pool at 10 and 20 feet deep and at the collection channel near unit 9.

Additionally, temperature sensors were place by contractor (WDFW) throughout the course of the juvenile passage system. Areas include, forebay pier noses, gatewells, powerhouse collection channel, spillbays, transport pipe, separator, and holding ponds. Sensors were also placed in the tailwater near the turbine boil of several units and at the barge loading dock.

Limnological and water quality samples were taken at river mile 295 and 326.

A solar powered water resonator was evaluated for algae control at Pasco Retention Pond 12-1, which is adjacent to McNary pool across from the north levy.

Field measurements for temperature, dissolved oxygen, conductivity and pH were taken. Laboratory samples were collected for various water quality parameters. With the exception of Biochemical Oxygen Demand (BOD) and dissolved oxygen (DO) all other parameters stayed the same. DO was often supersaturated while the resonator was in place and the algae problem had cleared up in seven weeks.

b. Proposed activities in 2004

Additional temperature data will be collected. A temperature string will be installed at the forebay.

3.3.3. Ice Harbor Project and Reservoir

a. Summary.

Sediment sampling was conducted for the proposed 2003/2004 dredging. Additional sediments were sampled under a COE Woody Riparian Program at Lost Island and Hollebeke sites. Funding for the Woody Riparian Program was provided under the Fish and Wildlife Compensation Plan in Washington State.

Temperature, velocity and bathymetry measurements were also taken. Extensive lists of pesticides were analyzed. The sediment information will supplement the Lower Snake River database and assist in future framework evaluations.

Limnological and water quality testing was conducted near Fish Hook Park at river mile 18.

Corps fish biologists placed battery operated temperature sensors that recorded readings hourly at fish passage facilities from 1 April through 31 October at the North Ladder exit pool, upper and bottom diffusers and upper and lower junction pools; at the South ladder exit pool, bottom diffuser, upper diffuser unit 6 and junction pool; Juvenile facilities at the North and South Collection Channels.

Turbine cooling water was monitored for high and low temperatures.

b. Proposed activities in 2004
A water quality pontoon and chain thermister temperature string will be installed at the forebay.

3.3.4. Lower Monumental Project and Reservoir

a. Summary.
Corps fish biologists placed battery operated temperature sensors that recorded hourly readings at fish passage facilities from 1 April through 31 October at: the North Ladder exit pool, upper and lower diffusers, junction pool and collection channel; South Ladder exit pool, upper and lower diffuser, transition pool; Juvenile Facility collection channel, primary dewatering, raceway, separator and sample holding tank. Turbidity measurements were taken daily between the south ladder picketed leads and scrollcase temperature was recorded.

TDG was recorded in the tailwater during a winter spill test.

b. Proposed activities in 2004
Two areas are scheduled for sediment analysis under the Woody Riparian program: Ayers and Magallon.

A water quality pontoon with chain thermister temperature strings will be installed at the forebay.

3.3.5. Little Goose Project and Reservoir

a. Summary.
Routine drinking water samples were taken monthly at service connections and tested according to Washington State Department of Health guidelines. Annual testing was performed for compliance on lead, copper, and inorganic constituents.

Wastewater testing was performed monthly and quarterly Discharge Monitoring NPDES reports were sent to EPA. Wastewater sludge was analyzed for phenols, volatile organics and TCLP metals. Sludge was hauled. Corps fish biologists placed battery operated temperature sensors that recorded hourly readings at fish passage facilities from 1 April through 31 October at: the exit pool, two pools below diffuser 13, diffuser 1, junction pool and north shore entrance and at the Juvenile Facility primary dewatering structure, separator, raceway 10 and Sample Holding Tank.

Sediment was sampled for an extensive list of pesticides for the Woody Riparian Study in the Lower Snake River at Ridpath, Willow Boat Landing, New York Island and Rice Bar. Sediment samples were taken for dioxin testing at Ridpath and Willow Boat Landing.

b. Proposed activities for 2004
Focus will be on re-deployment of temperature buoys in the forebay. The data will be used to develop District in-house model capabilities.

3.3.6. Lower Granite Project and Reservoir

a. Summary.
Routine drinking water samples were taken monthly at service connections and tested according to Washington State Department of Health guidelines. Annual testing was performed for compliance on lead, copper, and inorganic constituents. Volatile organics and mercury testing was performed to satisfy consecutive drinking water testing requirements from previous quarters.

Wastewater testing was performed monthly and quarterly Discharge Monitoring NPDES reports were sent to EPA. Routine tests were conducted to improve system operations.

Corps fish biologist placed a total of eleven battery operated sensors that recorded hourly temperature readings at the Lower granite fish passage facilities from March 25 though November 3 at: the ladder exit pool, diffuser 14, below diffuser 14, the fish viewing window, the ladder junction pool, the north powerhouse collection channel, the north shore collection channel, the collection channel by unit 6, the juvenile fish facility separator, raceway 5 and the juvenile sample holding tank.

Limnological and water quality sampling was conducted at three reservoir sites.

b. Proposed activities for 2004
A temperature string will be installed near the TDG station wall. Assistance will be given to any water or wastewater problems that personnel encounter at the facility.

3.3.7. Dworshak Project and Reservoir

a. Summary.
Data was downloaded from data logger strings placed at traditional water quality sites. New loggers were put into place.

A new water treatment system was completed for potable water at the dam. Additional pipework, a buffering system and automatic circuitry controls were installed.

Temperature information was downloaded form an Apprise thermister string located in the forebay at river mile three.

b. Proposed activities for 2004.
Temperature data will be collected at traditional water quality sites.

The thermister string in the forebay will be replaced by a water quality pontoon and thermister string capable of real-time transmission.

Temperature data will be taken at the selector gate areas in the tailwater.

3.3.8. Mill Creek and Virgil B. Bennington Lake.

a. Summary.

Fourteen Onset Optic StowAways® were installed at the Mill Creek Project in late May and removed at the end of September. Five were placed in Mill Creek between 5-Mile Bridge and the diversion to Yellowhawk and Garrison Creeks. Seven were installed between the upstream diversion and Lake Bennington. However, the flow to the lake ceased within a few days of installation and very little data were recorded. The final three formed a vertical array in the lake near the outlet control structure.

Sediment samples were collected from three locations in Lake Bennington on one occasion and analyzed for physical characteristics (grain size), inorganic components (metals, nutrients), and organic constituents (chlorinated herbicides, organophosphorus compound, semi-volatile organics, and N-methyl carbamates and urea).

Field data (temperature, pH, dissolved oxygen, conductivity, Secchi depth) and water samples for laboratory analyses (total suspended solids, particle size distribution, nutrients, alkalinity, ions) were also collected from Mill Creek and Bennington Lake during three field events in August and September.

b. Proposed Activities for 2004

Stevens Greenspan temperature probes are being evaluated at the Mill Creek Diversion structure. Temperature sensors will be installed this spring in Mill Creek, Bennington Lake and the diversion streams to evaluate spatial temperature gradients.

3.3.9. Lucky Peak Reservoir

a. Summary.

Vault toilets were installed at additional recreation sites. The pool was drawdown to accommodate construction activities at the Bureau of Reclamation's Arrowrock reservoir.

No routine water quality activities were conducted at this project. Most of the identified water quality problems associated with the Boise River occur downstream and independent of the project. Restoration and assistance services were not requested last year. Sediment was sampled for particle size analysis downstream at Eagle Island in the Boise River.

b. Proposed Activities. No new activities are currently planned.